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NTIS: National Technical Information Service, Springfield, Va. 22161. **Order by title and accession number: PB, AD, or HS.** When no PB number is given for NHTSA Technical Reports, order by prefacing the HS number with DOT, i.e. DOT-HS-000 000.

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. **Give corporate author, title, personal author, and catalog or stock number.**

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See publication: Articles in journals, papers in proceedings, or chapters in books are found in the publication cited. These publications may be in libraries or purchased from publishers or dealers.

SAE: Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale, Pa. 15096. Order by title and SAE report number.

TRB: Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

Corporate author: Inquiries should be addressed to the organization listed in the individual citation.

ABSTRACT CITATIONS

SAMPLE ENTRIES

FORMAT OF ENTRIES IN HIGHWAY SAFETY LITERATURE

NHTSA accession number ----- HS-013 124

Title of document ----- **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY MALE AND FEMALE DRIVERS**

Abstract ----- The object of this research was to obtain data concerning the maximum amount of brake pedal force that automobile drivers were able to sustain over a period of ten seconds. Subjects were told to apply the brakes in the test car as they would in a panic stop, and to exert as much force as possible on the pedal over the entire ten second test period. A total of 84 subjects were tested, including 42 males and 42 females. The results indicated that there is a wide distribution of values which characterizes the pedal force that the subjects were able to generate. Male subjects produced generally higher forces than did females. Over half the women tested were unable to exert more than 150 lbs. of force with either foot alone, but when both feet were applied to the pedal, force levels rose significantly.

Personal author(s) ----- bv C. R. VonBuseck

Corporate author (or author's affiliation) ----- General Motors Corp.

Publication date; pagination ----- 1973? ; 18p

Supplementary note ----- Excerpts from Maximum Parking Brake Forces Applied by Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are included.

Availability ----- Availability: Corporate author

NHTSA accession number ----- HS-018 924

Title of document ----- **NATURAL FREQUENCIES OF THE BIAS TIRE**

Abstract ----- The lowest natural frequencies of a bias tire under inflation pressure are deduced by assuming the bias tire as a composite structure of a bias-laminated, toroidal membrane shell and rigorously taking three displacement components into consideration. The point collocation method is used to solve a derived system of differential equations with variable coefficients. It is found that the lowest natural frequencies calculated for two kinds of bias tire agree well with the corresponding experimental results in a wide range of inflation pressures. Results of the approximate analysis show that the influences of the in-plane inertia forces on natural frequency may be considered small, but the influences of in-plane displacements are large, particularly on the natural frequency of the tire under low inflation pressure.

Personal author(s) ----- by Masami Hirano; Takashi Akasaka

Journal citation ----- Publ: Tire Science and Technology v4 n2 p86-114 (May 1976)

Publication date ----- 1976; 6refs

Availability ----- Availability: See publication

HS-023 934

THE USE OF RUBBER FOR IMPACT PROTECTION IN AUTOMOBILES

The requirement that automobiles should be protected from impacts has led to the adoption of new designs of natural rubber (NR) components and new NR compounds. There is great scope for designers and engineers to use impact-absorbing rubber units, high-modulus vulcanizates, and paintable rubbers in a wide variety of applications in the automobile field and elsewhere. A discussion is presented of rubber impact absorbers in bumper systems, material properties of NR compounds for bumper applications, energy absorption characteristics of various rubber compounds in small bumper sections, rubber compounds for flexible body components (sight shields or filler panels, and flexible front and rear ends), and paintability of rubber. Flexible rubber bumpers are designed to buckle, which allows high energy storage and minimizes the force transmitted to the body structure during impact. A soft facing would permit an element of pedestrian protection. Essential properties for elastomers used in flexible bumpers are high tear strength, elongation at break, good fatigue life, and environmental resistance. Good recovery after impact and low creep are also important. Compounds for flexible body components are designed less to absorb energy than to reduce impact damage and to allow greater bumper movement. Suitability of compounds for these applications can be tested by measurement of the flexural modulus, flexural set, and "droop". Candidate materials for flexible front and rear ends include thermoplastic and thermoset urethane elastomers and EPDM compounds (possibly reinforced with glass fibers), as well as certain NR compounds. Materials for external body work must be paintable, with the painting technique depending on the type of rubber substrate. EPDM needs an ultra violet surface treatment, and NR requires chlorination. Certain types of antioxidants, antiozonants, and waxes should not be used in compounding.

by A. D. W. Leaver

Publ: Rubber Chemistry and Technology v51 n1 p139-47 (Mar-Apr 1978)

1978; 4refs

Presented at Conference on Polymer Design Engineering, London, 29 Oct 1975. Reprinted from "Plastics and Rubber: Materials and Applications 1," p37-40 (1976) published by Peter Peregrinus Ltd.

Availability: See publication

HS-024 031

EXPERIMENTS WITH NOVEL FUELS FOR DIESEL ENGINES

Engine tests were conducted with two fuels that would be considered novel for use in diesel engines. The fuels, methanol and a water/diesel fuel emulsion, were used because of their potential for reduction in exhaust emissions and their ability to be produced in quantities sufficient for mining applications. Methanol as a diesel fuel yielded very poor exhaust emission characteristics. Emissions of CO (carbon monoxide), HC (hydrocarbon), and NOx (nitrogen oxides) were substantially increased over levels of No. 2-D fuel. Because of its adverse emissions level and low flash point, methanol does not appear to be a feasible alternative to diesel fuel for engines operating in underground mines. The use of an emulsified mixture of

water/diesel fuel in a diesel engine had no beneficial effects on emissions of NOx, caused slightly greater HC emissions, and reduced peak levels of CO and smoke. Since the reduction in CO and smoke levels could also be achieved quite easily by engine adjustment (by limiting maximum fuel rate), there were no net benefits.

by W. F. Marshall

Department of Energy, Bartlesville Energy Res. Center, Bartlesville, Okla. 74003

Rept. No. BERC/TPR-77/8; 1978; 9p

Availability: NTIS \$4.00 paper copy, \$3.00 microfiche

HS-024 032

ORGANIC EMISSIONS FROM AUTOMOBILE INTERIORS. FINAL REPORT

A research program was initiated to evaluate the potential for exposure of the general population to organic emissions of automobile interiors, specifically to vinyl chloride monomer (VCM), a suspected carcinogen in man. Six subcompact automobiles (Ford Pinto, AMC Gremlin, GMC Vega, GMC Chevette, NMC Datsun 710, and VW Rabbit) were evaluated for the emission of VCM and other organics into the passenger compartment. The quantitation of VCM was achieved using Lot No. 104 SKC charcoal cartridges interfaced with gas-liquid chromatography-mass spectrometry (GLC/MS) in the single ion mode. The interiors of the cars were thermostatically controlled at either 45 degrees C or 65 degrees C for 3 hr before sampling the car interior. Each car was sampled for VCM at both temperatures. Levels of VCM in the Ford Pinto, AMC Gremlin, GMC Vega, and GMC Chevette were less than the detection limit of 50 ppb. With improved instrumental parameters a limit of detection of 2 ppb was attained. Under these conditions no VCM was detected in the GMC Chevette. VCM was detected in the VW Rabbit at 4, with a standard deviation of plus or minus 3 ppb when sampled at 65 degrees C and less than 2 ppb at 45 degrees C. The NMC Datsun 710 was found to produce VCM levels of 7 plus or minus 2 ppb and 3 plus or minus 1 ppb at 65 degrees C and 45 degrees C, respectively. Since the Environmental Protection Agency has set the goal of zero emission for VCM, the low levels found in this study must be regarded as unacceptable. Further study of a larger, more statistically significant sample is recommended before any action is taken. Among the 147 organic compounds identified in the automobiles, several are listed as having carcinogenic or neoplastic effects and include aniline, biphenyl, 1,2-dibromoethane (tentative identification), dichlorobenzene (tentative identification), dimethylphenol isomers (some isomers carcinogenic), isobutyl alcohol, maleic anhydride (tentative identification), naphthalene, and 1,1,1-trichloroethane. Further quantitative evaluation of these compounds should be included in any vinyl chloride evaluation which might be undertaken.

by Ruth A. Zweidinger

Research Triangle Inst., P.O. Box 12194, Research Triangle park, N.C. 27709

EPA-68-02-1325

Rept. No. EPA-600/7-77-149; PB-280 374; 1977; 89p 14refs

Rept. for 15 May-22 Dec 1976. Interagency Energy-Environment Res. and Devel. Series.

Availability: NTIS

HS-024 033

FEDERAL-AID HIGHWAY ACT OF 1976, SECTION 210, STEERING AXLE STUDY [LOAD LIMITS ON FRONT AXLES OF COMMERCIAL TRUCKS]

In response to Section 210 of the Federal-Aid Hwy. Act of 1976, an investigation was conducted, in cooperation with industry consultants, into the relationship between the gross load on tractor front steering axles and the safety of operation of these tractors in combination with trailers. An increase in maximum gross weight limits to 80,000 lbs, authorized in 1974 for the interstate system, prompted the investigation. To obtain the maximum weight limit on standard tractor semitrailer units, the maximum 34,000 lbs would rest on the semitrailer tandem axles, 34,000 lbs on the tractor tandem axles, leaving 12,000 lbs on the steering axle. This weight distribution is achieved by moving the fifth wheel forward of the center of the drive axle. Labor representatives recommended a limit of 10,000 lbs on the steering axle to limit steering effort, reduce vibration, and increase safety in event of tire failure. Manufacturers and commercial users stated that a specific front axle load limit is not needed if front axles, tires, steering, and suspension systems are designed for the rated loads. An abbreviated test conducted by the National Hwy. Traffic Safety Administration indicated that overloading results in tire problems; that front axle loads increase when the fifth wheel is moved forward, increasing understeer (more desirable than oversteer); steering effort at low speed increases proportionately with the load on the front axle, and at higher speeds there is more than a proportional increase in effort; and that power steering decreases steering effort regardless of front axle weights. It is recommended that the Dept. of Transportation/Massachusetts Inst. of Tech. study on the effect of fifth wheel placement on front axle loads and vehicle stability by expanded to include actual vehicle tests. A study is recommended to determine if limiting the maximum length of the cargo carrying body is a feasible way to limit fifth wheel placement in relation to rear axles. Studies of ride quality should be made to determine the effect of fifth wheel placement and front axle load on driver safety. Rather than passing legislation specifying front axle load limits, the tire loading requirements of the Federal Motor Carrier Safety Regulations should be extended to all commercial motor vehicles (intrastate and interstate). Increased enforcement of these regulations should be instituted by Federal and state authorities.

Federal Hwy. Administration, Washington, D.C. 20590
1977; 127p 25refs
Availability: Corporate author

HS-024 034

MONOCULAR PERIPHERAL VISION AS A FACTOR IN FLIGHT SAFETY

The performance of static visual identification tasks and simulated operational flying tasks by pilots with binocular (B), adapted monocular (AM), and unadapted monocular (UM) (simulated by covering an eye) vision (nine subjects of each type) was measured in a unique operational visual simulator in order to investigate the efficacy of monocular pilots in performing visual tasks similar to those in flying and, in particular, to investigate the extent of potential decrements resulting from monocular vision. It was hypothesized that all pilots will demonstrate effective shrinkage of their peripheral visual

fields with increasing demands of a central visual task; that AM pilots with freedom of head movement will perform both static and dynamic visual tasks as well as binocular pilots under similar conditions; and that with heads fixed, B pilots will perform slightly, but not greatly, better than AM pilots, and much better than UM pilots. It was also hypothesized that AM pilots will perform better than UM pilots for both static and dynamic visual tasks. The static primary central task required sequential identification of dial readings. The dynamic primary central task involved simulated aircraft landing operations. During each set of primary tasks, a set of secondary peripheral visual tasks was performed. Results of the primary tasks and times of execution of the secondary tasks were subjected to analysis of variance. Factors included head position (fixed or free), stimulus location in peripheral field, eye state (seeing eye, blind eye), and type of central task (static, dynamic). All hypotheses were validated.

by D. S. Kochhar; T. M. Fraser
Publ: Aviation, Space, and Environmental Medicine v49 n5
p698-706 (May 1978)
1978; 9refs
Sponsored by Dept. of Transport, Ottawa, Canada.
Availability: See publication

HS-024 035

CASE REPORT OF AN OBSESSIVE-COMPULSIVE PERSONALITY: A PRECURSOR TO ACCIDENT PRONENESS

The social/physiological/psychological review of an aircraft accident involving input of incorrect controls and low-altitude ejection of a student naval aviator illustrated a possibly common problem, accident proneness resulting from an obsessive-compulsive nonpsychotic personality. Review of the pilot's history reflected a perfectionist attitude since childhood with continuous associated near-serious accidents. Flight training revealed occurrences of over-correction, channelized attention, and denial of errors. Since the demands of naval aviation spur the growth of the perfectionist, normal/abnormal parameters of obsession-compulsion must be cautiously examined as they present themselves.

by Guy R. Banta; David P. Kosnosky
Publ: Aviation, Space, and Environmental Medicine v49 n6
p827-8 (Jun 1978)
1978; 3refs
Availability: See publication

HS-024 036

SENSORY OVERLOAD AND THE DRIVING TASK

Sensory overload, or information overload, as related to the driver is discussed, with particular reference to the driver education process. Sensory overload occurs when the human mind is fed information too quickly or in too great a quantity for it to react in a normal manner. This can occur at three different levels (the sensory or perceptive level, the cognitive or thought level, and the decisional or judgmental level). A person's threshold for sensory overload can be lowered by such factors as emotional turmoil, fatigue, and drugs. Since it is known that there are over 1700 different parts of the driving task, it becomes easy to show how sensory overload can occur in the person who drives, especially if that person is inexperienced in a particular situation, such as driving in fog. The

driver educator should be aware that the sensory overload phenomenon does exist, and that it can occur during the course of instruction. Through the use of simulators, the instructor can introduce the student to situations requiring split-second responses without the serious consequences of mistakes under actual conditions. These situations can be rerun and action frozen at selected points for emphasis and further discussion. In this manner, the instructor can increase the student's stored knowledge and stimuli-processing abilities to avoid panic and decline in performance during a critical moment. During the in-car phase of instruction, the driver educator should be aware that comments to the student can contribute to possible sensory overload. By giving instructions before the car is in motion and limiting additional comments to directions and necessary verbal cues, the instructor can eliminate himself/herself as a possible overload stimulus. Commentary driving, either by the driving student or the observing students, can also reduce sensory overload.

by Lee Roy Lance, Jr.

Publ: Journal of Traffic Safety Education v25 n3 p33-4 (Apr 1978)

1978; 7refs

Availability: See publication

HS-024 037

TRAFFIC ACCIDENT SEVERITY AND ITS INFLUENCE ON SEAT BELT USAGE

The post-accident behavior and attitudes of motor vehicle operators toward seat belt usage were examined in a sample size of 940 drivers selected from all traffic accident reports filed with the Bryan, Texas, police department during 1975. Accidents were classified according to the most severe level of injury sustained, as follows: incapacitating injury (A), nonincapacitating injury (B), possible injury (C), and noninjury (D). Of the sample studied, 200 drivers were involved in accidents classified in the first three categories, the remaining belonging to the noninjury group. A single survey questionnaire was developed containing two sets of almost identical questions to measure the reported differential change in the behavior of the subjects before and after accident involvement. A statistical analysis of the survey results indicated that a significant change occurred in the drivers' seat-belt wearing habits. The overall trend was toward continued or increased usage of seat belts during local, non-local, and freeway driving after an accident classified C. After being involved in a "C" accident drivers more often asked or required passengers in the vehicle to wear seat belts. No significant change occurred in the reported behavior or attitudes of post-accident drivers, regardless of severity, toward favoring mandatory seat belt laws if a fine was involved for non-usage. It is concluded that the more severe the accident, the less influence on increasing seat belt usage, since severity C produced the greatest increase in seat belt usage.

by Allan Stern

Publ: Journal of Traffic Safety Education v25 n3 p35-6 (Apr 1978)

1978; 4refs

Availability: See publication

HS-024 038

CRASHWORTHINESS ENGINEERING OF AUTOMOBILES AND AIRCRAFT: PROGRESS AND PROMISE

Progress made in improving the technological resources of crashworthiness engineering (physical testing developments, analytical simulation techniques, and inventions and design tools) is reviewed, and some of the unresolved problems associated with development of design tools are defined in discussing modeling of structures and exteriors. It is concluded that physical test technology (setups, instrumentation, procedures, standards, data, data reduction) for automobile crashworthiness is well-advanced. A few organizations have performed extensive testing and have accumulated a high degree of expertise with broad experience. Controlled crash testing of aircraft is in its infancy, with respect to the amount of technology developed. A number of mathematical models are available for simulation in all areas of crashworthiness; the significant omissions in current technology are in insuring simulation fidelity and correlating with the real environment, particularly in the structures and bioengineering areas. Many injury-reducing devices (e.g. restraint systems) have been invented, tested, and are in use for highway and airborne vehicles; better utilization of the technology available for total system effectiveness awaits a spectrum of design tools to support the growing volume of specifications.

by R. J. Melosh

Publ: Journal of Aircraft v14 n7 p693-8 (Jul 1977)

1977; 102refs

Presented at 11th Annual Meeting and Technical Display of the AIAA, Washington, D.C., 24-26 Feb 1975.

Availability: See publication

HS-024 039

RISK OF INJURY TO MOTORCYCLE AND MOPED RIDERS AND REDUCTION OF HEAD INJURIES BY THE USE OF CRASH HELMETS (VERLETZUNGSRISEN VON MOTORRAD- UND MOPEDFAHRERN UND VERRINGERUNG DER KOPFVERLETZUNGEN DURCH TRAGEN VON SCHUTZHELMEN)

Data from 1206 moped and motorcycle accidents which occurred in Germany during the years 1974-1976 were analyzed for accident characteristics and injury consequences, and a systematic classification system for two-wheeled motor vehicle accidents was developed. Accidents are categorized by "type of collision" (the area and direction of force into the vehicle, type of other vehicle involved in accident, general area of impact (front/side/rear), exact area of the collision, and central axes of the vehicles involved relative to each other), and "dynamic characteristics" (the operating condition of the two-wheeled motor vehicle just before collision, the trajectory of operator/two-wheeled vehicle from beginning of crash phase to final position, and the distance between the operator/vehicle in the final position and the site of the accident). Safety proposals for motorcycles/mopeds were derived from an analysis of problem areas identified by the classification of the accidents. It is concluded that motorcycle and moped riders run the identical risk of injury in accidents. The wearing of crash helmets is definitely necessary, even by moped riders. The risk of severe/fatal head injuries is reduced by half when helmets are worn. The "full-face helmets" are especially effective

for protection against head injury to the rider. (Appended is a brief report by Mr. Langwieder on the requirement of helmet usage by moped/mofa riders, which was presented at the 25th Session of the Com. for Legislation, Munich, 10 Feb 1976.)

by K. Langwieder

Verband der Haftpflicht, Unfall-, Auto- und Rechtsschutz-versicherer e.V. (HUK Verband), Büro für Kfz-Technik, Leopoldstrasse 20, 8000 Munich 40, Germany

1978; 60p 9refs

Presented at Annual Meeting of German Society for Traffic Medicine, Frankfurt am Main, 7-9 Apr 1978. Translated from German (original text 22p; translation 38p).

Availability: Reference copy only

HS-024 040

AUTOMOTIVE ENERGY USE: A BASELINE PROJECTION FOR NEW YORK STATE

To assist the New York State Dept. of Transportation and the State Energy Office in understanding possible actions in the transportation sector that might lead to energy savings, a baseline projection of vehicle fuel usage was developed for each large metropolitan area in New York State (NYS) (Albany-Schenectady-Troy, Binghamton, Buffalo, Elmira, Poughkeepsie, Rochester, Syracuse, Utica-Rome, New York City-Long Island, balance of state). The effect of the following factors on fuel usage were investigated: increase of driving age population, increase in auto ownership levels, improvements in fuel efficiency of the car-fleet, and changes in miles driven per vehicle. The following four different mileage conditions, in terms of annual mileage driven per vehicle were tested to project fuel usage: no change in the 1975 annual miles per vehicle, 1% annual gain in miles per vehicle, 2% annual gain in miles per vehicle, and 1% annual decline in miles per vehicle. The short-term (five-year) and long-term (10 to 15 years) effects on demand for highway fuel usage in NYS were determined from this analysis. Results show that recent annual increases expected in vehicle miles of travel (VMT) can be sustained while still realizing significant reductions in total fuel usage (from current levels) due to increasingly fuel-efficient cars. Under the condition of 2% annual growth in travel per vehicle during the 1975-1990 period, one billion gallons of fuel will be "saved" in 1990 compared to fuel used for 1975 travel in NYS. Under the condition of no growth in annual VMT per vehicle, two billion gallons less fuel, about 40% less, will be required for 1990 travel. During this same period of time an additional million residents of driving age and 1.2 million vehicles are anticipated in NYS.

by David I. Gooding

New York State Dept. of Transportation, Planning Res. Unit, Albany, N.Y. 12232

Rept. No. Preliminary-RR-124; 1977; 50p 7refs

Sponsored in part by Dept. of Transportation. See also HS-024 041--HS-024 044.

Availability: Corporate author

HS-024 041

THE 1973-74 ENERGY CRISIS: IMPACT ON TRAVEL

To assist the New York State Dept. of Transportation and the State Energy Office in understanding possible actions in the transportation sector that might lead to energy savings, a description of urban travel behavior before and during the energy crisis of 1973-74 was developed. Using a home-inter-

view survey taken in Buffalo, N.Y., in the fall of 1973, just before the crisis, a view of pre-crisis travel patterns was developed, emphasizing the differences in gasoline use by demographic groups, in order to recognize potential hardship. Results show that men travel about twice as far per day as do women, that travel increases at a decreasing rate as auto ownership increases, and that the middle-age groups (21 to 50) travel significantly more than the young or elderly. From a review of studies of travel behavior changes during the energy crisis, it is concluded that the availability of gasoline is a more important factor in determining travel demand than its price; that only those persons with some flexibility in travel behavior do the conserving and those travelers usually have high levels of auto ownership and income; and that for most people transit ridership was not an important alternative (although it rose during the crisis) in combatting the gasoline shortage, even in areas with good transit service. These conclusions seem to indicate that policies using price to reduce gasoline consumption will be ineffective among the higher-income households (those with the greatest potential to conserve) and will severely impact the lower-income families. Policies aimed at travelers with some flexibility in travel choices would be the most effective in conserving fuel, and would not impose severe hardships on any one group.

by Alfred J. Neveu

New York State Dept. of Transportation, Planning Res. Unit, Albany, N.Y. 12232

Rept. No. Preliminary-RR-131; 1977; 28p 16refs

Sponsored in part by Dept. of Transportation. See also HS-024 040, and HS-024 042--HS-024 044.

Availability: Corporate author

HS-024 042

TRENDS IN NYS [NEW YORK STATE] AUTO PURCHASE PATTERNS, 1973-77

To assist the New York State (NYS) Dept. of Transportation and the State Energy Office in understanding possible actions in the transportation section that might lead to energy savings, data on all personal-use motor vehicles registered in New York State during Jan 1973 and Jun 1977 were analyzed to discover trends in gross vehicle weight (GVW) as indicators of fuel efficiency. NYS auto registration and driver's license files were merged to permit analysis of demographics of car owners. It was found that GVW increased steadily during the period, and that the age (but not sex) of the owner is an important indicator of the amount of the increase. The rate of increase in GVW is most dramatic for young people, the least dramatic for early middle-aged people, and steady for middle-aged and older people. The increase can be attributed to consumer preferences as well as to model changes. Women generally register lighter cars than men do; young people generally register lighter cars than older people do. The entire fleet of vehicles increased 2.3% during the period, primarily the result of increases in cars registered by women. Among the policies proposed to encourage purchasing of more fuel-efficient cars, are the following: monitoring new car sales for fuel efficiency; increasing consumer awareness of the advantages of smaller, more efficient cars; and using dealer- and consumer-based monetary incentives to make smaller, more efficient cars more attractive. The first two policies should be implemented immediately. Consumer awareness could be increased via DMV (Dept. of Motor Vehicles) distribution, new car sales stickers, magazines, television, and radio. The third policy should only be considered if trends in car-purchasing behavior do not appear to change. Among the proposed ac-

ns under this policy are waived sales tax on electric cars, w interest loans and new car rebates for fuel-efficient cars, d incentives to remove old cars from the market.

K.-W. Peter Koeppel; Wayne R. Ugolik
New York State Dept. of Transportation, Planning Res. Unit,
Albany, N.Y. 12232
Rept. No. Preliminary-RR-132; 1977; 73p 16refs
Sponsored in part by Dept. of Transportation. See also HS-024
00-HS-024 042 and HS-024 043-HS-023 044.
Availability: Corporate author

HS-024 043

Automotive Energy Forecasts: Impact of Carpooling, Trip Chaining, and Auto Ownership

to assist the New York State Dept. of Transportation and the
State Energy Office in understanding possible actions in the
transportation sector that might lead to energy savings, the im-
pact on automotive fuel usage of policies dealing with carpool-
ing, trip chaining, and auto ownership is predicted. Using data
from a 1970 statewide home-interview survey, base year (1975)
automotive fuel calculation is calculated for urban, small
urban, and rural areas of upstate N.Y. as a function of trip
length, by purpose, trip length, auto occupancy, auto ownership,
and automotive fuel efficiency. The upstate area of N.Y. con-
sumes about 3.0 billion gallons of gasoline annually. Forecasts
are made of automotive fuel use at a 1980 baseline, and the
impact of various carpooling and trip-chaining policies on au-
tomotive fuel consumption is predicted. The policies analyzed
are those generally given the greatest public support: limit on
cars weighing 4000 plus lb, carpooling, chauffeur service in
urban areas, and trip combining. Results show that, while dif-
ficult to achieve, a 25% increase in carpooling for work and
drop trips would save about 5.8% of 1980 automotive transpor-
tation energy. Trip-chaining policies oriented at weekday and
weekend non-work travel would save 10% to 13%. Several ac-
tions ("carpool coordinators" and "transportation audit") are
suggested for consideration as ways to achieve these savings.

by Nathan S. Erlbaum; Gerald S. Cohen; David T. Hartgen
New York State Dept. of Transportation, Planning Res. Unit,
Albany, N.Y. 12232
Rept. No. Preliminary-RR-134; 1977; 44p 12refs
Sponsored in part by Dept. of Transportation. See also HS-024
00-HS-024 042, and HS-024 044.
Availability: Corporate author

HS-024 044

Public Opinion Survey on Energy and Transportation

to assist the New York State Dept. of Transportation and the
State Energy Office in understanding possible actions that
might lead to energy savings, a statewide telephone opinion
poll of New York State (NYS) residents was conducted during
the fall of 1977. A random sample of 500 interviews was col-
lected statewide with sampling proportional to population; the
demographic characteristics of the sample compare favorably
with the state distributions observed in the 1970 Census. The sur-
vey dealt primarily with issues in planning energy-saving ac-
tions in transportation. Opinions were collected on general ap-
proaches for conserving energy and specific conservation poli-
cies. The responses were analyzed along three characteristics
residential location (New York City, large metropolitan, small

metropolitan, rural), sex, and age). One of the key findings of
the survey is that most people feel there is, or will be, an
energy problem in the U.S. NYS residents do not believe that
any one sector should be given the most concentration in ener-
gy planning; the support is equally split among homes, indus-
try, business, transportation, and government. The encourage-
ment of transit use within cities is the most preferred approach
to save transportation energy. Encouraging train and intercity
bus travel is the next most preferred approach, followed by
getting drivers to cut gas use. NYS residents strongly support
incentive programs in all three general approaches. Another
key finding is that most respondents feel that the elderly and
handicapped should be given special attention when planning
energy-saving action in transportation; this group received far
more support than any other group considered.

by Alfred J. Neveu
New York State Dept. of Transportation, Planning Res. Unit,
Albany, N.Y. 12232
Rept. No. Preliminary-RR-135; 1977; 50p 3refs
Sponsored in part by Dept. of Transportation, and the New
York State Energy Office. See also HS-024 040 -HS-024 043.
Availability: Corporate author

HS-024 045

Dynamics of Automotive Sulfate Emissions. Interim Report.

A preliminary assessment of the potential environmental im-
pact of automotive sulfuric acid (H₂SO₄, for sulfate) aerosol
has been made by analyzing the aerosol dynamics. This analy-
sis leads to the prediction of ambient automotive H₂SO₄
aerosol concentrations over and around a large, ten-lane
highway (48 m x 20 km), ten or so years hence, when almost
all cars in the U.S. will be fitted with catalytic converters. The
attachment rate of fine automotive H₂SO₄ aerosols to ambient
aerosols is examined. The dispersion and deposition of au-
tomotive sulfate are modeled over the highway for "worst
case" meteorology using K-theory. The neutralizing effect of
ambient ammonia on H₂SO₄ concentrations around the
highway is examined by a direct simulation procedure for
dispersion calculations. These calculations indicate that au-
tomotive H₂SO₄ emissions may result in adverse health effects
to sensitive individuals and in increased rates of corrosion.

by S. H. Suck; K. De Bower; J. R. Brock
University of Texas, Austin, Tex. 78712
EPA-R803660
Rept. No. EPA-600/3-78-043; PB-280 559; 1978; 58p 17refs
Ecological Res. Series. Rept. for Nov 1975-Nov 1976.
Availability: NTIS

HS-024 046

Glossary of Automotive Electronic Terms--SAE J1213. Information Report

This information report of the Electronic Systems Com. of the
Society of Automotive Engineers (SAE), approved Jun 1978,
presents definitions of automotive electronic terms which are
subject to revisions and corrections before inclusion in the
1979 "SAE Handbook".

Society of Automotive Engineers, Electronic Systems Com.,
400 Commonwealth Drive, Warrendale, Pa. 15096
1978; 8p
Preprint; final version to appear in "SAE Handbook," 1979 ed.
Availability: SAE

HS-024 047

HSL 79-04

HS-024 047

AN INSTRUMENTED CAR TO ANALYSE ENERGY CONSUMPTION ON THE ROAD

An instrumented car is described which is capable of gathering realistic data on vehicle operating conditions in a wide variety of surroundings ranging from motorways to heavily-congested urban roads, and the results are presented of a preliminary test using the car (Ford Escort 1300) to evaluate the energy saving potential of one traffic management strategy. Direct measurements were taken of certain basic parameters such as gasoline flow rate, throttle opening, propeller shaft rotation rate, and propeller shaft torque. In-car processing and subsequent computer analysis provide information on such parameters as speed, acceleration, power output, engine efficiency, and fuel consumption. A series of distributions presents this information in a form which emphasizes important trends without obscuring significant detail. Preliminary tests in central Glasgow (Scotland) have demonstrated the value of the instrumented car and supporting system. The results also provide information on the repeatability of fuel consumption measurements, on the effects of traffic management, and on urban driving patterns.

by D. Easingwood-Wilson; P. M. Nowotny; T. C. Pearce
Transport and Road Res. Lab., Assessment Div., Crowthorne,
Berks., England
Rept. No. TRRL-LR-787; PB-280 516; 1977; 30p 11refs
Availability: NTIS; Corporate author

HS-024 048

EFFECTS OF NOISE AND HEARING ACUITY UPON VISUAL DEPTH PERCEPTION AND SAFETY AMONG HUMANS

Considering the possible adverse effect of the impairment of depth perception on personal and occupational safety, research was initiated in an attempt to determine whether noise does in fact have an effect on stereoscopic depth perception. Past clinical research has indicated a statistically significant increase in the error of depth perception among selected test subjects during and at the end of five-minute exposures to steady-state white noise at various intensities ranging from 85 A-weighted decibels (dBA) to 110 dBA. Repeated testing of 59 human volunteers showed that exposure to steady-state, broad-band, high-intensity noise ranging from 70 dBA to 115 dBA for time periods of several minutes did not reduce significant changes in visual depth perception errors as measured by the Howard-Dolman test. Any error in stereoscopic depth perception produced by exposure of humans to broad-band white noise between 70 dBA and 115 dBA is so small that such a perturbation is inadequate for establishing community or occupational noise standards. Other auditory effects, such as permanent or temporary threshold shifts, speech interference, and annoyance, are more important criteria.

by Edward R. Hermann; Carolyn S. Hesse; E. Robinson
Hoyle; Anne C. Leopold
University of Illinois at the Medical Center, School of Public
Health, Chicago, Ill.
Rept. No. IIEQ-77/10; PB-280 365; 1977; 39p 39refs
Availability: NTIS; Illinois Inst. for Environmental Quality,
309 W. Washington St., Chicago, Ill. 60606

HS-024 049

THE OUTLOOK FOR AUTOMOTIVE FUEL SUPPLIES, ALTERNATIVE VEHICLE ENGINES, AND POTENTIAL IMPLICATIONS FOR TRANSPORTATION TAX STRUCTURES (1985-2000). FINAL REPORT

Potential developments in automotive fuel supplies, alternatives to the Otto engine, and implications of projected developments in these areas for state road user tax arrangements are examined. Natural crude petroleum supplies will be supplemented by synthetic crude and alcohols. Short-term (5 to 10 years) shortages in fuel supplies could develop if development of alternative fuels is postponed. In the longer run, automotive fuel supplies seem reasonably assured, with real prices rising probably less than 100% above current levels. Alternative heat engines, electric vehicles, and fuel cells are considered with regard to the state of their technological development and ability to utilize nonstandard fuels. Modified Otto or other heat engines (fuel-injected, stratified-charge SI (spark ignition), gas turbine (Brayton cycle), Stirling cycle, Rankine cycle (steam engine), diesel) will likely dominate the market, while widespread use of electric vehicles will require major breakthroughs in advanced batteries, barring significant and prolonged shortages of liquid fuels. Alternative taxing arrangements briefly evaluated are the following: Btu (British thermal unit)-based tax on liquid fuels, increased annual registration fees for alternatively-powered vehicles, electric flow recharge metering, tax on traction batteries, periodic odometer readings, and road surface checkpoint metering.

by William Barron; Edwin Crawford; Morton Weinberg
Maryland Dept. of Transportation, Strategic Financial Planning
Group, Baltimore-Washington International Airport, Md. 21240
Rept. No. PB-279 679; Staff-2; 1978; 204p refs
Prepared in cooperation with Center for Metropolitan Planning
and Res., Johns Hopkins Univ.
Availability: NTIS

HS-024 050

FOR THE LATEST IN ENERGY STORAGE, TRY THE FLYWHEEL [TRANSPORTATION AND OTHER APPLICATIONS]

From regenerative braking in automobiles to peaking power for utility operations, the flywheel has become a key element in developing primary and hybrid systems for energy storage. Using new composite materials and other sophisticated engineering components, the flywheel has been redesigned to meet the needs of an oil-shortage economy. The most immediate applications are in transport vehicles, but there are other promising uses ahead in utilities, solar power, and wind turbine facilities. The discussion includes the following topics: flywheels for automotive regenerative braking, improved performance of electric vehicles by use of flywheels, development of efficient and practical flywheels on many fronts, ERDA's (Energy Res. and Devel. Administration) major goals and benefits expected from flywheel energy storage systems, flywheel design considerations, improving stress and energy density of flywheel composite materials, flywheel cross sections, flywheel bearings, input-output devices of flywheel systems, flywheel housings, projections for flywheel energy

storage performance, electric drive flywheel, and utility flywheel applications.

by George C. Chang; Fritz Hirschfeld
 Publ: Mechanical Engineering v100 n2 p38-45 (Feb 1978)
 1978; 5refs
 Availability: See publication

HS-024 051

AUTO EMISSIONS: WHY REGULATION HASN'T WORKED

The government program to control motor vehicle emissions in the U.S. is a well-intentioned effort to limit an important source of atmospheric pollutants, but the program has been poorly designed, resulting in slow progress in controlling emissions, high costs, and distorted incentives for motorists and manufacturers to seek and apply methods of reducing emissions. An alternative approach, relying mainly on effluent fees, would have yielded faster, less costly progress in emissions control. It would also have assured continuing incentives for research and development on new and improved control devices and sources of motive power. This suggests that an effluent fee program, even if implemented today, could still yield substantial improvements for the 1980's. Using this proposed approach, effluent fees would be levied on all new motor vehicles sold on the basis of measured emissions over 50,000 miles by a test sample of each make and model. Manufacturers would submit vehicles for testing before selling them as is done now; a small fleet would be tested for 50,000 miles and a larger fleet for 4000 miles, with the results for the latter extrapolated to 50,000 miles. The average emissions for each model through 50,000 miles would be used to compute the effluent fee for that model, on the basis of the following formula: Fee equals $F_{HC} \cdot HC$ plus $F_{CO} \cdot CO$ plus $F_{NOx} \cdot NOx$, where F_{HC} , F_{CO} , and F_{NOx} are individual fees for hydrocarbons (HC), carbon monoxide (CO), and nitrogen oxides (NOx) emissions, respectively. The HC emissions would include evaporative and blow-by as well as combustion emissions. The three fees should be set to equate the marginal benefits and marginal costs of abatement in each case. As a fairly realistic example, the following fee schedules are proposed: for low-pollution areas, F_{HC} equals \$6.33/g/mile, F_{CO} equals \$1.14/g/mile, and F_{NOx} equals \$25.00/g/mile; for high-pollution areas, F_{HC} equals \$19.00/g/mile, F_{CO} equals \$3.45/g/mile, and F_{NOx} equals \$75.00/g/mile. For an uncontrolled car, the total fee in a low-pollution area would be about \$300. The fee for a car that meets 1975 interim standards in the same area would be \$106, while the extra cost to the manufacturer of equipping the car to meet these standards is estimated at \$280. These fees are designed to encourage manufacturers to build cars that meet the 1970 standards for low-pollution areas and the 1975 California standards for high-pollution areas. Although fee schedules differing between regions are proposed, it is suggested that a single Federal schedule for all new cars at the level of the low-pollution area be used, with each state permitted to add its own extra effluent fees on cars it registers.

by Edwin S. Mills; Lawrence J. White
 Publ: Technology Review v80 n5 p55-63 (Mar-Apr 1978)
 1978; 11refs

Abstract of a paper presented at Workshop on Air Pollution and Administrative Control, Massachusetts Inst. of Tech. (MIT), Cambridge, Mass., Dec 1976; full text in "Approaches to Controlling Air Pollution," Ann F. Friedlaender, ed., to be published by MIT Press in Apr 1978. Research sponsored by MIT, and Sloan Foundation.
 Availability: See publication

HS-024 052

IMPROVING THE MOPED'S STATUS AND SAFETY

Several moped safety problems identified from a recent survey of 100 randomly-selected moped owner/operators in several Southern California beach cities are discussed and solutions recommended. It was found that over 2/3 of the survey group regularly executed turning maneuvers without prior signals. The amended FMVSS (Federal Motor Vehicle Safety Standard) 123, Section 5.12, allows the repositioning of the rear brake control on mopeds from the right foot to the left handlebar. This placement makes it impossible for the moped rider to signal before making a turn while using the left hand to engage the rear brake. By rescinding the FMVSS amendment 108, Section 4.1.1.26 (which states that a motor-driven cycle whose speed attainable in 1 mile is 30 mph or less need not be equipped with turn lamps), the problem created by the relocation of the rear brake control would be rectified. The survey also pointed out the glaring lack of driver preparedness. It was found that only 8% of the survey group had a Class 4 (motorcycle endorsement) on their drivers' licenses. A possible means of increasing moped rider preparedness might be for the California Dept. of Motor Vehicles to establish a special license classification for the moped, including a written test and a driving proficiency test. It was found that there were no driver education classes dealing solely with the moped; increased dissemination of driver education materials might be achieved through the promotion of moped handbooks used in conjunction with class meetings held by owner/dealer clubs. The survey elicited that a number of unsafe practices were common among moped owners. Most of the moped owners willingly lent their vehicles to friends and family members. This practice might be discouraged to some extent by presenting its dangers via moped rider courses. It was found that many of those surveyed had at some time carried passengers on their vehicles and 97% of those surveyed admitted that they did not regularly wear helmets. Safety equipment, especially helmets, must be strongly emphasized in moped rider courses as both life and limb savers.

by Michael L. Evans
 Publ: Journal of Traffic Safety Education v25 n3 p10, 30 (Apr 1978)
 1978; 5refs
 See also HS-801 908 and HS-013 646. Based on Survey for Master's Thesis, California State Univ., Los Angeles, 1977.
 Availability: See publication

HS-024 053

METRIC FASTENERS--DESIGN AND PERFORMANCE OPPORTUNITIES

Metric threaded fasteners being developed in North America by ANSI (American National Standards Inst.) -OMFS (Optimum Metric Fastener System) activity differ in some important respects from current ISO (International Standards Organization) standards. Specifications for three fastener types which are now being considered as draft documents for national standards (hex cap screw and hex bolt, 12-spline flange screw, and hex nuts) are discussed in terms of possible improvements in weight, performance, and value/cost ratios. This discussion is designed to encourage further research on metric fasteners and to encourage companies considering conversion to metric to contribute to the development of ANSI metric standards, adopting these for their own use rather than uncritically accepting existing ISO standards. Further benefits

may be achieved in the following areas: weight savings in OMFS hex head screw designs; raw material and possible weight savings in using formed hex head cap screws; weight savings possible using reduced diameter body screws; improvement in elastic elongation of reduced diameter body screws; improvement in the design of the 12-spline flange screw by increasing diameter of the spline drive and reducing its wrenching height; and potential for development of a thinner, non-heat-treated hex nut for use with Property Class 9.8 screws.

by John C. McMurray
Russell, Burdsall and Ward, Inc.
Rept. No. SAE-770421; 1977; 9p 5refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 054

**COGNITIVE ACCIDENT-AVOIDANCE TRAINING
FOR BEGINNING DRIVERS**

Programmed instruction/testing was used to teach safety techniques to 192 high school students in driver education. The independent variable was training feedback/testing on four levels: no test and no feedback; test with an IBM answer format, but no item feedback; test with a punchboard answer format and immediate individual item feedback; and double testing with punchboard answer format and training feedback. Pressey punchboards, which provided the programmed testing training, registered a response and immediately indicated the correctness of the choice. If initially wrong, a student continued working until that item was correct. Separate analyses of variance were performed for number of driving accidents and moving violations year-by-year in the three years following training. For the first year only, the punchboard-twice drivers had one-fourth the accidents of the no-test control drivers (p less than .05). Investigation on prolonging the beneficial effect is needed.

by Donald H. Schuster
Publ: Journal of Applied Psychology v63 n3 p377-9 (1978)
1978; 5refs
Availability: See publication

HS-024 055

STAYING ALERT ON THE HIGHWAY

Illustrations and step-by-step instructions are presented for performing 15 isometric exercises designed to help the driver to stay alert on the highway and to relax after a journey. These exercises were developed by Robert R. Speckman, Jr., Head Athletic Trainer at Southern Illinois Univ. Fatigue, tension, and falling asleep at the wheel are insidious safety hazards that can trap even the most experienced driver. Target areas for the exercises are neck, shoulders, abdomen, hips, and back. It is suggested that the six-second exercises described be tried at the first sign of a headache or tense, cramped muscles. It is further recommended that the driver plan regular rest and six-second exercise stops based on individual fatigue tolerance.

Publ: Robot n98 p4-5, 8-9 (May-Jun 1978)
1978
Reprinted from a booklet presented by Budget Rent a Car, and Transamerica Insurance Group.
Availability: See publication

HS-024 056

**CAUGHT IN THE ACT [TACHOGRAPHS RECORD
DRIVER PERFORMANCE]**

The advantages of using tachographs or similar recorders, particularly for the fleet operator, include safeguarding against vehicle abuse, lowering transport costs, and increasing safety. Tachographs operate by means of a number of styli which record on a slow-moving, wax-coated chart whether the vehicle is standing or moving, what distances are traveled and at what speeds, and how the driver handles the vehicle. These devices can also serve as mobile security systems as they prevent fiddling by drivers, theft of costly km from the employer, and the surreptitious use of the employer's vehicle in transporting stolen goods. The tachograph has been instrumental in preventing use of a vehicle for criminal activities. Various other less comprehensive products determining abuse of the vehicle or improper driving techniques are also available. One of these devices involves a "black box" which counts the number of times the brakes of a vehicle are applied too severely, acceleration is too rapid, or corners are taken too quickly. Another apparatus is used mainly to determine whether a vehicle, during the period in use, is coasting, exceeding the speed limit, over-running, or being excessively braked or accelerated. Both apparatus have audible warning devices which indicate to the driver when a fault is being recorded and are intended to curb unsafe driving practices.

Publ: Robot n98 p6-7 (May-Jun 1978)
1978; 1ref
Availability: See publication

HS-024 057

HOW TO APPROACH TRAFFIC CIRCLES SAFELY

Some guidelines are presented for drivers on how to negotiate traffic circles safely. The information is based largely on good road sense and on observation of established patterns. For the sake of clarity and convenience, only traffic circles with four entrances and four exits are considered, including traffic circles with single lane and two-lane entrances. Among the guidelines are establishment of a procedure and following it without fail, signalling for a left turn only between exits and never signalling for a right turn, and not changing lanes. Pedestrians and cyclists are advised to avoid traffic circles.

by Gerrit Fourie
Publ: Robot n98 p12-4 (May-Jun 1978)
1978
Availability: See publication

HS-024 058

FUTURE VEHICLES AND OCCUPANT PROTECTION

A question-and-answer session with Dr. John W. Melvin of Hwy. Safety Res. Inst. (HSRI), is presented, relating to the crashworthiness of cars and protection of occupants, with particular reference to vehicles of the future. It is stated that future cars will not look much different from today's cars, but they will perform better in protecting the driver and passengers. The cars will have a stronger occupant compartment, a tougher capsule, surrounded by crushable structures to absorb the energy of a collision and reduce the force on the occupants. There will be much greater use of existing components

as energy-absorbing components, rather than adding structures for energyabsorbing capacity. The research safety vehicles (RSV's) displayed at the Experimental Safety Vehicle Conference show a good combination of properties likely to be featured in future production cars, i.e. better crashworthiness and fuel economy, low exhaust emissions, and still reasonable interior roominess. Cars will have better restraint systems, both active and passive, but the timing of changes depends considerably on Federal regulations. The major breakthrough in the immediate future with regard to injury protection is increased use of restraint systems by drivers and passengers. Most cars on the road have at least lap belts, if not lap-belt/shoulder-harness combinations. If people would use these restraints in significant numbers (80% to 90%), a dramatic decrease in serious injuries and fatalities would result.

Publ: Robot n98 p18-20 (May-Jun 1978)
1978
Reprinted from HSRI Research.
Availability: See publication

HS-024 059

EUROPEAN VEHICLE SAFETY STANDARDS AND THEIR EFFECTIVENESS

Some information is presented concerning the effectiveness of various European vehicle safety standards. The data reviewed on seat belts, door locks, steering columns, and fuel leakage indicate that standards need to be examined to determine their actual level of effectiveness in preventing accidents. Monitoring of such regulations is a necessary and integral part of the whole process of regulating motor vehicle design. This monitoring process has not happened in Europe in any comprehensive manner, and as a result, regulations are enforced which do not reflect the circumstances of actual collisions. It is emphasized that without a realistic and continuing monitoring program of research on the effectiveness of regulations car design will continue to be specified which conforms to complex legislative procedures, but which in reality offers less than optimum protection to road users (including pedestrians).

by G. M. Mackay; P. F. Gloyns; H. R. M. Hayes; D. K. Griffiths
Publ: Robot n96 p8-11 (Jan-Feb 1978)
1978; 15refs
Availability: See publication

HS-024 060

EVALUATION OF AN EXPERIMENTAL TREATMENT FOR PROBLEM DRIVERS

The effectiveness of a new treatment for problem drivers with the National Safety Council's Defensive Driving Course (DDC) was compared with a control group. The new approach to the rehabilitation of problem drivers was developed by the staff of the Traffic Safety Education Evaluation Project at Florida State Univ., with support from the Florida Governor's Hwy. Safety Commission and the National Hwy. Traffic Safety Administration, and with assistance from the Florida Dept. of Hwy. Safety and Motor Vehicles and the National Safety Council. The course, entitled Responsible Driving, uses mainly group discussion, role-playing, and other experimental activities to help problem drivers become aware of their driving behavior. It is designed to create a desire to change behaviors identified as irresponsible, and to provide a system

for making positive changes in problem driving behavior. The system is based on major concepts and principles of the theory of personality developed by Berne (1964; 1972) called transactional analysis (TA). In the present study, hearing officers from four large Florida cities randomly assigned 432 problem drivers, whose licenses had been suspended, to three groups. Safety officers from each of the four locations taught both the experimental course and the DDC. Pretests and post-tests on driving knowledge and attitudes were administered to the three groups. Driving record data of the 358 subjects who completed treatment were used to help identify long-term effectiveness of the treatments. Although there was no significant improvement in driving knowledge or attitudes shown by the groups after treatment, the experimental group had a greater reduction than the DDC group and a significantly greater reduction than the control group in traffic law violations and collisions during a one-year follow-up period. A larger investigation of the effectiveness of the experimental course is recommended.

by Jon C. Prothero
Publ: Human Factors v20 n4 p489-93 (Aug 1978)
1978; 15refs
Availability: See publication

HS-024 061

MAIN FACILITY RESEARCH SUMMARY: DYNAMIC SIGN SYSTEMS FOR NARROW BRIDGES. FINAL REPORT

An overview is presented of the Maine Facility, a two-lane rural highway test site, and an experiment conducted at the facility between Aug and Dec 1976 is summarized. This is the second in a series of reports planned to summarize completed experiments run at the Maine Facility. The first report (FHWA-RD-77-54) describes five experiments (1973-1976) which involved speed control in rural school zones, evaluation of speed control signs for small rural towns, narrow bridge warning devices, flashing traffic control devices at intersections, and passive signs at railroad crossings. The Maine Facility is a 15-mile (24-km) section of electronically-instrumented two-lane highway capable of detecting vehicles and their approximate size and tracking their positions in real time. The facility serves as a test site (data collection and reduction) for obtaining basic traffic characteristics data and for developing and evaluating static and dynamic traffic control remedial aids in the interest of improving safety and the level of service on rural two-lane highways. The present experiment was designed to test and evaluate the application of dynamic (activated) sign systems in alerting motorists to the presence of narrow bridges on two-lane rural highways. The results of the study show that strobe lights, flashing beacons, neon signs, and lights illuminating the bridge were only slightly more effective than static signs in causing drivers to alter their travel speed (2 mph reduction) or their lateral position in approaching and traversing the bridge. Opposing vehicles and road geometry seemed to have the greatest effect on driver

behavior. (For more details of the experiment, see DOT-TSC-FHWA-78-3.)

by Joseph S. Koziol, Jr.
Transportation Systems Center, Kendall Square, Cambridge,
Mass. 02142
Rept. No. FHWA-RD-78-33; DOT-TSC-FHWA-78-4; 1978; 18p
5refs
Rept. for Jun 1976-Dec 1977. Sponsored by Federal Hwy.
Administration. Rural Road Experimentation for Traffic Safety
and Capacity 21.
Availability: NTIS

HS-024 062

NORTH DAKOTA TRAFFIC TRENDS: 1967-1977

Statistics are tabulated and graphed for North Dakota traffic which show trends for 1967-1977 (motor vehicle registrations, licensed drivers, vehicle miles traveled, deaths, injuries, accidents, mileage death rate) and figures for 1977 (types of accidents, violations and contributing circumstances, driver age and accident involvement, and age and sex of fatalities and persons injured). In 1977 N. Dak. traffic accidents, 180 persons were killed and 6346 injured; 7.2% of all licensed drivers in N. Dak. were involved in a traffic accident, a reportable accident occurring every 30 min. One person was injured every 1 and 1/2 hr; one person was killed every two days; 40.5% of all fatalities were persons between ages of 14 and 24, 79% of fatalities, male. Of fatal accidents, 58% involved a single motor vehicle; 39% occurred on Saturday and Sunday; 45% occurred after dusk and before dawn; and 63.9% occurred on dry surface with clear weather conditions. Vehicles approaching at right angles accounted for 11% of fatal two-motor vehicle collisions and 10% involved head-on collisions; 43% of all drivers in fatal accidents were under 25 years of age; and 63% of vehicles involved in accidents were passenger cars. The total number of registered motorcycles was 26,027 vs. 24,590 in 1976; 364 motorcycles were involved in accidents (13 in fatal accidents, 326 in injury accidents); 80 pedalcycles were involved in accidents (2 in fatal accidents, 77 in injury accidents); 50 school buses were involved in accidents (11 in injury accidents); and 55 emergency vehicles were involved in accidents (15 in injury accidents).

North Dakota Hwy. Dept., Capitol Grounds, Bismarck, N.
Dak. 58505
1978; 4p
Printing sponsored by National Hwy. Traffic Safety
Administration.
Availability: Corporate author

HS-024 063

SEAT BELT AND SHOULDER STRAP USE AMONG URBAN TRAVELERS. RESULTS OF THE SUMMER 1977 SURVEY [VIRGINIA]

During nine days in June 1977, four major metropolitan areas of the State of Virginia (Roanoke-Salem-Vinton, Alexandria-Arlington-Fairfax-Belvoir, Richmond-Henrico -Chesterfield, and Norfolk-Virginia Beach-Hampton) were surveyed to determine seat belt usage by urban travelers. Observer-data collectors were stationed at selected signalized intersections. Motorists in the lane adjacent to the curb were shown a clipboard bearing the question, Are you wearing seat belts? The observer then approached the vehicle and visually verified the response given, and recorded whether seat belts and/or

shoulder straps were being used. Also recorded was the license number of the vehicle and the sex and approximate age of each occupant. An association was noted between the driver's use of belts and the right-front passenger's (RFP) use. In vehicles in which the driver was not using a seat belt, 96.7% of the RFP's were not using seat belts. When the driver was using only a lap belt, 42.7% of the RFP's were using either the lap belt or the lap and shoulder belts. When the driver was using both lap and shoulder belts, 54.6% of the RFP's were using either the lap belts or the lap and shoulder belts. The last two figures for RFP use do not include the use of child seats, which added 1.6% and 1.3% to the totals, respectively. It was found that only 16.3% of the drivers, 9.8% of the RFP's, and 3.4% of the remaining passengers used a seat belt and/or shoulder strap. Overall, 10.3% of the infant occupants were restrained by approved child seats. The results indicate that more female drivers and RFP's use belts than do male counterparts. Belt use was found to be highest by drivers of 1972/1973 model cars and by RFP's of 1975 model cars. A greater percentage of Northern Va. (Alexandria-Arlington, etc.) drivers and RFP's used belts than those in the other survey areas, and use was lowest for all occupant categories in Eastern Va. (Norfolk-Virginia Beach-Hampton).

by Charles B. Stoke
Virginia Hwy. and Transportation Res. Council, Box 3817,
University Station, Charlottesville, Va. 22903
Rept. No. VHTRC-79-R5; 1978; 32p
Sponsored by Virginia Dept. of Transportation Safety.
Availability: Virginia Dept. of Transportation Safety

HS-024 064

TO PREVENT HARM [INSURANCE INSTITUTE FOR HIGHWAY SAFETY ACTIVITIES SINCE 1969]

A review is presented of some of the Insurance Inst. for Hwy. Safety's research, demonstration, and communications projects undertaken since its reorganization in 1969. Examples of the Institute's work in identifying, defining, and analyzing a range of real-world highway loss problems and countermeasure alternatives are categorized as precrash, crash, and post-crash areas of investigation. For each project, the issue involved and the problem to be solved are stated, and the Institute's action is described. Pertinent references are noted in the accompanying bibliography, safety films are described, and relevant issues of the Institute's "Status Report" are listed. In the precrash category, the Institute has sought to find means to change human, vehicular, and environmental factors contributing to the initiation of motor vehicle crashes in order to reduce the end-result losses. Research in this area has included work on the use of drugs in relation to driving, on the influence of driver training on fatal crashes, and on the effectiveness of drunk driving "crackdown" enforcement programs in reducing fatal crashes. The Institute has investigated the possibilities for achieving substantial increases in the voluntary use of active restraint systems. It has found design and manufacturing defects in new cars which led to manufacturer recall campaigns. It has also identified road characteristics associated with disproportionately high frequencies of fatal, off-the-road crashes. Institute research has focussed on the contribution of such vehicle factors as size, passenger compartment characteristics, and restraint systems to crash injuries severity, and has identified opportunities for substantially reducing such injuries and fatalities through modest, technologically available improvements in motor vehicle design. The need for greatly improved passive restraint

side hazard problem. In the postcrash area, an Institute crash test program identified a pattern of poor design in car fuel tank systems. Other areas of Institute investigation include assessment of injury severity, contribution of the motorcycle and bicycle to highway losses, analysis of accidents involving pedestrians, the role of motor vehicle crashes in spinal cord injury, unreported crash damage, and crash loss characteristics of vehicle makes and models. Other topics include carbon monoxide poisoning, cost-benefits of motor vehicle performance standards, and systematization of highway loss countermeasures.

Insurance Inst. for Hwy. Safety, Watergate 600, Washington, D.C. 20037
1978; 101p refs
Availability: Corporate author

HS-024 065

DETECTION AND READING DISTANCES OF RETROREFLECTIVE ROAD SIGNS DURING NIGHT DRIVING

Three experiments on the detectability of reflectorized road signs included the following factors: color and reflective intensity of the retroreflective sheeting on the sign, size of the sign, and effect of glare from an oncoming car. Two experiments on the legibility of these signs investigated the effect of reflective material (four standard brands) and the effect of very high and very low reflective intensities. The results indicate that for obtaining optimal detectability and legibility distances, the reflective intensity of a new road sign should be in the range of 4 mcd/lux.sq cm to 10 mcd/lux.sq cm. For signs in this range of reflective intensity, it was shown that doubling the area of a sign increased a detection distance of about 600 m by about 150 m to 200 m. Opposing headlights on an oncoming car decreased detection distances of 500 m to 900 m by about 100 m. It was found that standard signs with a text 170 mm high permitted reading from a distance of about 115 m.

by S. Dahlstedt; Ola Svenson
Publ: Applied Ergonomics v8 n1 p7-14 (Mar 1977)
1977; 11refs
Sponsored by Swedish Road Safety Office, and Swedish Council for Social Science Res.
Availability: See publication

HS-024 066

AN INVESTIGATION INTO THE LEVEL OF PROTECTION AFFORDED TO FULLY RESTRAINED PASSENGER VEHICLE OCCUPANTS

Preliminary findings are reported of an ongoing study (initiated in spring 1975) by Transport Canada to assess the level of protection currently afforded to fully-restrained passenger vehicle occupants. The study involves the early retrospective investigation of accidents in defined geographic regions across Canada in which a fully-restrained occupant sustained an injury of severity level AIS (Abbreviated Injury Scale) 2 or greater. The analyses are based on a sample of 94 case vehicle occupants investigated during the first full year of data collection (1976-1977). Findings show the head/face and chest to be

restraint system. Interior compartment intrusion likely increased the severity of the injuries received by over a quarter of the occupants in the sample. The possibility of complete occupant ejection appears to be virtually eliminated through the use of lap/torso belts. Partial ejection through the window area, however, remains a serious problem, particularly in collisions which result in a rollover. Other events which likely compromised the optimum possible levels of protection included seat-back loading by unrestrained rear-seat occupants, the rearward displacement of the steering assembly, and excessive belt slack. The increased relative importance of providing side impact protection for a fully-restrained vehicle population was also shown. Side interior intrusion was found to be a major cause of injury at the severe end of the injury spectrum. In frontal impacts, interior compartment integrity was maintained in all but the most severe of collisions. If the level of protection in frontal impacts is to be improved, future restraint systems will need to be designed so that they more efficiently utilize the survival space afforded by the vehicle.

by D. J. Dalmotas; P. M. Keyl
Transport Canada, Vehicle Systems Div., Ottawa, Ont., Canada; University of Calgary, Calgary Accident Res. Study, Calgary, Alta., Canada
1977; 16p 9refs
Availability: Transport Canada, Road and Motor Vehicle Traffic Safety Branch, Vehicle Systems Div., Ottawa, Ont., Canada

HS-024 067

CERVICAL FRACTURES AND FRACTURE-DISLOCATIONS SUSTAINED WITHOUT HEAD IMPACT

A review is presented of reports found in the literature on cervical injuries produced without impact to the head (in particular, injuries sustained in automobile accidents) and case histories of such injuries which were obtained from the data file of the Univ. of Michigan's Hwy. Safety Res. Inst., as well as results of experimental and clinical studies conducted to investigate such injuries in animals, cadavers, and volunteer subjects. Although not so common as injuries caused by head impacts, cervical fractures and/or fracture-dislocations without direct impact to the head have been reported. Some of these cervical injuries have been sustained by wearers of lap and shoulder belts who have been involved in auto accidents. Belt use is not considered a potential hazard because ample evidence has accrued in the medical and engineering literature to document general injury and fatality reduction by use of seat belts.

by Donald F. Huelke; Robert A. Mendelsohn; John D. States; John W. Melvin
Publ: Journal of Trauma v18 n7 p533-8 (Jul 1978)
1978; 83refs
Availability: See publication

HS-024 068

FLORIDA BICYCLE RULES OF THE ROAD

This easily understood booklet is a driver's manual for bicycle riders of all ages in the State of Florida. It contains traffic

laws, information about highway signs and traffic control signals, information about purchasing a bicycle, and care and maintenance tips. Information is presented in the following chapters: the bicycle; signals, signs, and pavement markings; traffic laws; bicycle safety rules; parents' responsibility; and recreational benefits of cycling in Florida. Abundant color illustrations are provided.

State of Florida, Governor's Hwy. Safety Commission,
Tallahassee, Fla. 32301
1977; 80p

Adapted in part from Illinois Bicycle Rules of the Road.
Availability: Corporate author

HS-024 069

EVALUATION OF THE EFFECT OF INCREASES IN HEADLAMP PHOTOMETRICS (RE: DOCKET 78-05; NOTICE 1)

A headlamp evaluation model was developed and applied to the investigation of the proposed doubling of the permitted candlepower for high beams in automotive headlighting systems in the U.S. from 75,000 cp to 150,000 cp. The model was developed to evaluate headlamp performance under a great variety of constantly changing traffic and environmental conditions. It is concluded that the proposed increase in candlepower may not result in an overall improvement in headlighting performance in traffic. Although the higher intensity lamps can increase seeing distances in certain unopposed traffic situations, this study indicates that in two-way traffic, the higher intensities may increase driver discomfort. The 150,000 cp headlamps on high beam can demonstrate seeing distance improvements in unopposed driving of 15% for pavement markings and 35% for detection of pedestrians, but increased glare from the brighter headlamps will discomfort 10% to 25% more drivers than the present system. There was also a decrement in seeing distances for drivers in opposing and preceding (fixed mirror) vehicles when the higher cp headlights were encountered. It was found that a given level of opposing and preceding driver visual discomfort would be reached earlier or at a greater distance when the proposed high beam intensities were encountered.

Ford Motor Co.
1978; 30p 6refs
Attachment to Doc-78-05-N01-120A (4-10-78).
Availability: Corporate author

HS-024 070

HEX FLANGE BOLT HEAD WEIGHT REDUCTION DESIGN CRITERIA

As a result of acute steel shortages and an accompanying reduction in the production of fasteners, Ford Motor Co. initiated programs to reduce actual material usage by redesigning certain fasteners. One of these programs involved the design of hex flange bolts, both inch and metric series, having heads reduced in volume to the least amount without degrading manufacturing or assembly requirements. Head dimensions were developed through a partly empirical equation involving all normal bolt strength test criteria, plus the added criterion that driving capacity must be no less than twice the torsional strength. The design was validated in the laboratory and on the production line. An annual material saving of 2000 tons of

steel in Ford's production resulted by replacing the standard hex flange bolts with the reduced head design.

by Janos F. Nagy
Ford Motor Co.
Rept. No. SAE-770422; 1977; 10p 3refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 071

DESIGN OF METRIC MACHINE AND TAPPING SCREWS

As a result of contributions by many fastener engineers in both Canada and the U.S., and in particular a CFI (Canadian Fasteners Inst.) Working Group of the ISO/TC (International Standards Organization/Technical Com.), a system has been designed that utilizes the same head for metric screws having machine and spaced tapping threads. This family of metric fasteners includes pan, flat, and raised countersunk heads, both slotted and recessed, and hexagon and hexagon washer heads. The starting points for this proposal for standardization of screw heads were ISO/TC 2 (WG 5) Draft Proposals 648 through 653, ANSI (American National Standards Inst.) B18.6.3, and ANSI B18.6.4. Because ANSI screw heads are identical and because ANSI B18.6.4 contains tapping screw information, essentially only this specification was used. The purpose of this proposed system is to provide a significant step forward in international fastener standardization. To avoid needless controversy, both the M6 and M6.3 machine screw thread sizes are included. For the same reason, a hexagon size of 16 mm was used on the M10 hexagon head screws. Of particular interest in this project are the analytical approaches taken to develop the designs. A formulation to calculate the torque capabilities of Phillips recesses was used to determine recess depths in all recessed product. Formulations were also developed to calculate recess volumes so that head volumes could be accurately assessed. A computer program employing the Monte Carlo principle was used to calculate minimum material clearance between recess and screw outer surfaces, underhead bearing areas, and head material volumes. The complete formulations of all dimensions, design criteria, and details of the analytical studies are presented. For the sake of simplicity, all material has been arranged in order of the machine screw draft proposal number, with each proposal pair (machine and tapping screws) placed together.

by Ray Ollis, Jr.
Procor, Ltd., P. L. Robertson Mfg. Div.
Rept. No. SAE-770423; 1977; 40p
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 072

GMC MOTORHOME BODY CONSTRUCTION [GENERAL MOTORS CORPORATION]

The body construction of the GMC (General Motors Corp.) Motorhome is described by tracing the evolution of the design from inception through styling, engineering, and assembly. By providing the designers with general criteria and allowing them significant latitude, the design was approached more from the "aesthetic pole" than from the functional, beginning with

aesthetics and aerodynamics and having the functional requirements engineered into the styling concept. The styling and the desired parameters of light weight and corrosion-resistance determined the choices of available materials and techniques. The result is a quasi-monocoque body construction with a welded aluminum substructure, and molded SMC (sheet molding compound) fiberglass and aluminum skins. The skins are adhesive-bonded to the substructure with mechanical fasteners used very sparingly, more as fixturing devices. The framework design allows a great deal of flexibility of carline locations, making it relatively easy to adapt the vehicle to different floor plans and multiple applications. Even though the design is well-established, work is now underway to make the Motorhome body lighter and more aerodynamically efficient. Future GMC Motorhomes will utilize more exotic construction materials and techniques, with efforts being directed at a purer monocoque design.

by Lyn C. Hollis
General Motors Corp., Truck and Coach Div.
Rept. No. SAE-770424; 1977; 12p
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 073

THE USE OF HONEYCOMB SANDWICH CONSTRUCTION IN RECREATIONAL VEHICLES

The need for lightweight, high strength construction methods and materials for recreational vehicles (RV's) as a result of the energy shortage, has led the RV industry to consider the honeycomb sandwich construction technique. This construction technique, which combines the advantages of strength, stiffness, and drastically reduced weight, is versatile enough to meet a variety of design requirements. By combining the features of stiff, strong facing materials with lightweight cores, the RV designer can obtain panels to suit such items as counter and table tops, closet doors, partitions, roof and side walls, and now entire floor systems. A honeycomb sandwich provides the strength and stiffness needed by using the principle of "high moment of inertia". Just as an I-beam, for example, derives its stiffness primarily from the flanges which take the imposed load in tension and compression, while the web of the I-beam ties the flanges together and takes the resulting shear stress, so do the facings of a sandwich panel carry the load in tension or compression while the core takes care of the shear forces. Unlike the web of the I-beam, honeycomb can provide uniform and overall support for the facings, resulting in very smooth, continuous surfaces. The honeycomb sandwich construction technique is discussed in terms of materials (aluminum foil - 4 alloys, Kraft paper, Nomex paper, and fiberglass reinforced phenolic); facings, adhesives, and processing; and panel joints, edgings, or close-outs.

by Jay Brentjes
Hexcel Corp.
Rept. No. SAE-770425; 1977; 11p
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 074

ON THE VEHICLE DEVELOPMENT OF THE DUAL MODE BUS SYSTEM

The development is outlined of the Dual Mode Bus System, with particular emphasis placed on the vehicle. This system provides manned operation as in a conventional bus on ordinary roads, and unattended operation on guideways under the control of a central computer. This system can be realized by a combination of currently available technical components without any special technical innovations, a requisite condition for early establishment. Certain safety and reliability factors remain to be tested. To analyze the operational stability of the lateral guidance system, computations using a simulation model, and experiments using test cars were conducted on two types of guidance systems: a linked type (connecting the guidance mechanism with the steered wheel), and a nonlinked type. The side-member contact guidance system can provide the riding comfort and reliability required of the Dual Mode Bus, and is also highly practical with regard to cost and weight. Both the linked type and the nonlinked type fulfill the required functions satisfactorily from the technical standpoint. In terms of practicality, the former type is on the whole somewhat superior, considering the size of the vehicle used in the experiments. Where considerations of exhaust gas pollution and noise are of prime importance, the battery-motor power system offers the best choice and offers reliable and practical hardware. On the other hand, where power performance on roads, cruising range, economy of operation, ease of maintenance, etc., are paramount, the engine-motor system could be advantageous. Construction details are given for the following systems: power, braking, lateral guidance, switching, and communication and control.

by Shin Maki; Tomokazu Tokuda; Tooji Takemura; Hiromichi Uchiyama; Yukiyoshi Sasabe
Nissan Motor Co., Ltd., Japan
Rept. No. SAE-770426; 1977; 18p 14refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 075

NEW DEVELOPMENTS IN MAGNETIC SUSPENSION AND PROPULSION FOR TRANSPORTATION

The most recent accomplishments in the on-going development of the magnetically levitated and propelled ROMAG transportation vehicle are described. The ROMAG system, begun in 1970 by Rohr Industries, uses electric linear induction motors for vehicle thrust and for dynamic active suspension, thereby eliminating separate lifting and guiding electromagnets or superconducting magnets with their inherent drag. The ROMAG development program has progressed through test, evaluation, and demonstration phases to the point where it is proven that magnetic levitation and propulsion are feasible and practicable for application in public transit systems. Advantages of magnetic levitation/propulsion include low noise, smooth ride, low pollution, high reliability, low maintenance, and high efficiency.

by W. J. Holt; J. A. Ross
Rohr Industries, Inc.
Rept. No. SAE-770428; 1977; 8p
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 076

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HS-024 076

A LOW NO_x LIGHTWEIGHT CAR DIESEL ENGINE [NITROGEN OXIDES EMISSIONS]

A new automobile diesel engine concept has been developed to the preliminary engine design level and demonstrated by simulating vehicle tests with a computer model using steady-state engine dynamometer data. The preliminary design is a six-cylinder, swirl chamber diesel of 209 CID (cubic inch displacement) and 130 GHP (gross horsepower). This concept engine weighs 495 lb and employs turbocharging, variable compression ratio (VCR), high prechamber-main chamber volume ratio, and exhaust gas recirculation (EGR). Steady-state engine tests were conducted on an existing automobile diesel, modified to simulate the concept engine. Test results were converted to urban cycle results for a 3000 lb GVW (gross vehicle weight) vehicle through the use of a computer model. Emission results (g/mile) are .21 NO_x (nitrogen oxides), .24 HC (hydrocarbon), and 1.24 CO (carbon monoxide). Fuel consumption (miles/gallon) is 30.3 urban cycle and 36.4 highway cycle. Vehicle cycle results at 3700 lb GVW meet all emission requirements and exceed the future 27.5 mpg requirement by 10%. Multifuel capability and 175 psi BMEP (brake mean effective pressure) power levels were also demonstrated.

by Stephen H. Hill; Joseph L. Dodd
Teledyne Continental Motors, General Products Div.
Rept. No. SAE-770430; 1977; 30p 7refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977. Research sponsored by Energy Res. and Devel. Administration.
Availability: SAE

HS-024 077

ENGINE SEQUENCE TESTING OF RE-REFINED LUBRICATING OILS

Two oils reclaimed from used automotive crankcase drainings using BERC (Bartlesville Energy Res. Center)-developed technology and one commercially re-refined oil were subjected to standard bench tests and engine test sequences to measure their quality. A commercially re-refined SAE 20 automotive lubricating oil successfully passed the IIC, IIIC, VC, and L-38 engine-test evaluations required by automobile manufacturers to meet the standards established for service SE. Two samples of used lubricating oil feedstock that were processed by BERC-developed technology successfully passed IIC, IIIC, and VC evaluations. One of these processed oils (1526) was a 165 SUS vis (at 100 degrees F) blend of 150/250 SUS solvent-treated distillates which was hydrotreated over a cobalt-molybdate catalyst at 500 degrees F/650 psig with a space velocity of 1. The other processed oil (1538) was a solvent-treated distillate blend of clay-contacted 150/250 SUS stocks blended to 180 viscosity. Each of these two samples was also formulated with a commercial additive package and viscosity index improver to give SAE 10W30 grade finished oils. Of these 10W30 grade samples, the one produced from 1527 passed both IIIC and VC sequence tests and failed the IIC; the same sample with 1% sulfonate-type corrosion inhibitor passed the IIC evaluation. The other sample (produced from 1539) successfully passed the IIIC test, and with additional corrosion inhibitor passed the IIC evaluation after an initial fail. Although the fourth performance test required for service SE, the L-38, was not run on these samples, a bearing-corrosion bench test was run on the oil produced from 1527, and resulting data showed a successful pass. This study is believed to document the first

successful passing of engine sequence tests in the U.S. by re-refined lubricating oils to meet standards established for service SE.

by J. W. Reynolds; M. L. Whisman; C. J. Thompson
Energy Res. and Devel. Administration, Bartlesville Energy Res. Center, Bartlesville, Okla.
Rept. No. SAE-770431; 1977; 8p 6refs
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 078

CORVETTE-THE BUYER AND THE CAR

Insight into what has made the Corvette such a success in the marketplace is given by exploring important factors in the car-buyer relationship as a guide to future product decision-making. The Corvette has just finished its most successful year in which over 46,600 cars were produced at a wholesale dollar value exceeding one-third of a billion dollars, approximately 1% of the gross sales of General Motors (GM). This sales record has been a continuing trend over several years, uninterrupted by oil embargo or recession and limited only by the number of cars that could be built. In many ways the Corvette buyer today is very much like his/her historical counterpart who bought the car for its style, performance, and handling, although buyers today are accepting less performance. Corvette buyers rank the resale value of the car higher in importance than price as a reason for purchase. The high resale value is a function of the demand for used Corvettes and the market recognition of the Corvette as a long-life vehicle. The fiberglass body gives the used Corvette buyers assurance of buying a sound car. Old Corvettes today are accruing in value. The broad spectrum of owner clubs, and special publications and magazines devoted to the Corvette, stimulates the Corvette market and is unique among domestic automobiles. All manner of performance parts are available in the aftermarket. The extensive customizing of Corvettes suggests that many owners are striving for unique expression. In past years Corvette has offered buyers a wide range of engines including fuel-injection, small engine blocks, and the tremendously powerful mechanical lifter big block engines. Although these special engines contributed greatly to the Corvette's reputation, few purchases were actually made. Comfort and convenience options have been more popular than optional engines. Power steering, power brakes, and the custom interior with leather seats have been made standard equipment as a result of this trend. The youth of the new Corvette buyer (median age of 30) and the lack of second-choice alternatives suggest that awareness of and demand for the Corvette may begin as early as the teenage years. The rapid falloff in purchase with age and the low repurchase rate are explainable in terms of changing family demands, but the strong influence of the Corvette leads to the purchase of other GM cars. It might be possible to extend the age of Corvette buyers if a 2 plus 2 version were available. The low level of repeat buyers has apparently reduced the demand for product change; in fact, if the demand for the Corvette begins in the teen years and is not satisfied for 10 years, this may argue for a very long product life cycle.

by David R. McLellan
General Motors Corp., Chevrolet Motor Div.
Rept. No. SAE-770432; 1977; 8p
Presented at International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 079

A DISCUSSION OF ALTERNATIVE SPORTS CAR CONCEPTS

Sports car concepts and packages are dominated by the location of the power unit; a discussion is presented of the relative merits of the front-, mid-, and rear-engined car concepts. After a discussion of some basic packaging considerations and their legal implications comparisons are made of performance potential with respect to traction and aerodynamics. Limiting power/weight ratios are derived. Primary and secondary ride implications are reviewed and effects on braking mentioned. Steering and cornering characteristics are assessed by first establishing correlation between prediction and measurement using actual vehicles. Means of simplifying the prediction of steady-state steering characteristics are described. Two "model" cars of front- and mid-engined configuration are then used to predict the steady-state and dynamic steering consequences of various specification changes and some conclusions are drawn as to inherent differences. If downright maximum performance is required and a really high-powered engine and transmission assembly can be made available within the cost parameters, then the mid-engine concept is entirely justified, especially at power/weight ratios above 90 bhp/1000 lb. Some reduction in weight and aerodynamic drag are the only justifications for use of a mid-engine arrangement for a two-seater car of relatively modest performance. The steering and cornering behavior of the smaller front engined car should be at least equal to that of its mid-engined counterpart if similar tire specifications are used. Front engine placement eliminates the problem of creating a special power unit and transmission assembly and provides improved ride and interior noise levels. The preceding comments relating to the small car also apply to the 2 plus 2 arrangement. This type of sports car is usually expected to be more luxurious and adapted to general-purpose use. Four occupants require more luggage space, even if two of the passengers are children. Refinement of ride and interior noise level is of some consequence in such a car. Again, steering response and cornering power should be comparable to that of a mid-engined equivalent if a similar tire specification is employed. The rear-engined arrangement appears to have few advantages. In the broad view, it is felt that there is a fine balance of influences involved in the decision as to whether a small two-seater should be front- or mid-engined, and that both types should continue to sell. It is felt that the balance is decidedly in favor of a front-engined concept for the 2 plus 2 configuration.

by R. J. Knight; J. N. Randle
British Leyland UK Ltd., Jaguar Engineering Div.
Rept. No. SAE-770433; 1977; 24p
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 080

THE M.A.N. [MASCHINENFABRIK AUGSBURG-NURNBERG A.G.] M-COMBUSTION SYSTEM IN THE PASSENGER CAR DIESEL ENGINE

Tests using the direct-injection "M" combustion system in a small high-speed diesel engine have shown that the "M" system, which in the past has been applied only to commercial-vehicle engines, has inherent capabilities for use in passenger car engines. Its advantages over pre-combustion chamber engines vary with respect to fuel economy and noise

level. Taking into account a subjective judgment of general ride comfort, no difference was found from indirect-injection systems, although the pinking noise after cold starting, characteristic of indirect-injection systems, has been eliminated with the "M" engine. The speed of 5000 rpm which was attained in various tests manifested no performance limit of the "M" system. A tendency toward excessive exhaust emissions was initially observed, associated with the much wider operational speed range of the small high-speed units for car applications compared to commercial-vehicle applications. In small-displacement engines, the mixture-formation problem in the direct-injection engine is greatly aggravated at low speed and low load, and leads to an enhanced emission of unburnt hydrocarbons (HC). Development work following the initial tests led to considerable improvement in exhaust gas quality, primarily by installation of a variable-area injection nozzle (pintle nozzle). Replacement of the constant-area nozzle with the variable-area type corrected the problem of excessive wall-deposited fuel at low speeds and low loads, and increased the proportion of fuel distributed directly in the air charge. This enabled mixture formation and combustion to be adjusted in this operating range to provide a decisive reduction in HC emission and odor. The adoption of load-sensitive adjustment of the injection timing in addition to speed-sensitive injection timing used so far only for commercial-vehicle "M" engines also reduced NOx (nitrogen oxides) emission as expected without any appreciable sacrifice in other engine results. In the test car (3500 lb test weight), the CVS (constant volume sampler) test limit data (0.41 g/mile HC, 3.4 g/mile CO (carbon monoxide), and 2.0 g/mile NOx) laid down in the ERDA (Energy Res. and Devel. Administration) Specification 1975 for the development of a diesel engine passenger car were obtained or bettered. The direct-injection "M" system also lends itself very well to an increase in output by supercharging.

by A. Neitz
Maschinenfabrik Augsburg-Nurnberg A.G., Germany
Rept. No. SAE-770434; 1977; 15p 8refs
Presented at International Automotive Engineering Congress
and Exposition, Detroit, 28 Feb-4 Mar 1977.
Availability: SAE

HS-024 081

OPERATION AND BENEFITS OF A TAILGATE FOR OFF HIGHWAY REAR DUMP TRUCKS

The benefits of attaching a tailgate to off-highway rear dump trucks are enumerated. The fitting of a tailgate equips a truck to utilize the entire length and width of the bed, permitting larger loads; it also avoids spillage. Better weight distribution enables each tire to support equal load, reducing tire costs, and simplifies dumping. A case study of a firm that installed AUTOGATE tailgates shows an improvement in fuel usage and reduction in tire wear. The AUTOGATE tailgate, differentiated from the hinged, swinging type, has a center rear plate bolstered for strength and open at both sides. The left and right sidearms are pivoted to the sides of the truck body, with L-shaped flanges that slide into the open sides of the center rear plate, enabling the gate width to be varied up to 12 inches. The tailgate is adjustable for any truck. As the body dumps, the gate automatically lifts toward the cab canopy, al-

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lowing an 80-95 degree (relative to the body) high clearance opening.

by L. B. (Phil) Philippi
Philippi-Hagenbuch, Inc., Ltd.
Rept. No. SAE-770501; 1977; 6p
Presented at Earthmoving Industry Conference, Central
Illinois Section, Peoria, Ill., 18-20 Apr 1977.
Availability: SAE

HS-024 082

A NEW TEST CONTROL AND DATA ACQUISITION SYSTEM FOR EXPERIMENTAL TESTING OF AUTOMATIC TRANSMISSIONS

Operating and system features are described for a new computerized test control and data acquisition system for experimental testing of transmissions at Detroit Diesel Allison's engineering test facility for transmission products used for hauling, cycling, and military purposes. The purpose of the test system is to provide a better transmission product by facilitating test activities, which include performance, development, and durability testing. The test system is capable of handling many different models of automatic and powershift transmissions, varying in size, horsepower, and complexity. The system, designed only for test cell operation, is a minicomputer-distributed ("hierarchical") system, and consists of satellite, intermediate, and host computer levels. It is used in conjunction with ten engine-powered test stands and six DC-dynamometer-powered test stands. The major design criteria for the system include dedicated transducers and instruments, more accurate measurements, closed loop control, repeatable operation, simplicity of operation, minimum computer programming, and task-oriented computers. The operating characteristics described here include the general configuration, control room configuration, test control modes (dynamometer manual, engine-powered manual, and engine-powered automatic), automatic test control program generation (learn and repeat, field cycle simulation, fabricated cycles), setup procedure, data acquisition (dynamometer steady state data acquisition, data display, failure mode analysis, high speed burst data), data reduction (real time, off-line, field data reduction) and safety monitoring (emergency shutdown, "B" stop, coast stop, normal stop, alarm routines). The detailed system description includes information flow, transducers, the instrumentation island, intermediate level features, and the central data laboratory.

by M. D. Smith; B. R. Trewartha
General Motors Corp., Detroit Diesel Allison Div.
Rept. No. SAE-770511; 1977; 16p
Presented at Earthmoving Industry Conference, Peoria, Ill.,
18-20 Apr 1977.
Availability: SAE

HS-024 083

DEVELOPMENT OF TYPE C-3 TORQUE FLUID FOR HEAVY-DUTY POWER SHIFT TRANSMISSIONS

Steps in the development of the new Type C-3 transmission fluid specification are described. This specification defines more stringent requirements for fluids used in heavy-duty off-highway automatic or powershift transmissions. A laboratory test program was conducted to develop and prove out the updated requirements. The C-3 specification now provides for

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control of the fluid's effect on clutch friction retention and durability. A redefined oxidation stability test has been included which calls for the use of more readily available test hardware. Seal-swell requirements were expanded to include the latest materials used in transmission seals. At present, 110 fluids have been qualified by the oil industry to this specification, and they are performing very well. Many of the fluids being qualified are previously approved Type C-2 fluids. The remainder are predominantly engine oils or special Type C-3 formulations for replacing Type C-2-approved DEXRON fluids no longer available. The cooperative efforts of the petroleum and additive industries, along with Detroit Diesel Allison, are now providing an improved fluid for use in the latest off-highway heavy-duty transmissions.

by C. R. Potter; R. H. Schaefer
General Motors Corp., Detroit Diesel Allison Div.
Rept. No. SAE-770513; 1977; 8p
Presented at Earthmoving Industry Conference, Peoria, Ill.,
18-20 Apr 1977.
Availability: SAE

HS-024 084

NOISE CONTROL IN PLANETARY TRANSMISSIONS

A program initiated to investigate sources and causes of transmission noise is described, including methods developed to reduce or eliminate that noise. In tests with an experimental transit coach, two noise peaks were encountered: a mid-range gear whine and shift chirp. These were found to be the result of the resonance of some vehicle component when excited by planetary gear mesh vibrations. Transmission modifications did not change the observed resonant frequency, indicating a probable resonance external to the transmission. Since the planetary gear meshes excited the resonance, transmission modifications which decreased planetary gear mesh vibrations would reduce the noise. Two methods of decreasing these vibrations were successful: improving gear tooth profiles and counterphasing the planetaries. Decreasing gear tooth involute crown and improving accuracy decreased peak vehicle interior noise 2 to 5 dB(A). The required accuracy would require production development and might increase cost. By choosing the proper timing relationship between multiple planetary pinion meshes, shift chirp and peak vehicle interior noise were reduced an average of 7 dB(A). Of the three different designs tested, the most effective should, theoretically, eliminate the total planetary torsional vibrations.

by W. E. Palmer; R. R. Fuehrer
General Motors Corp., Detroit Diesel Allison Div.
Rept. No. SAE-770561; 1977; 16p 11refs
Presented at Earthmoving Industry Conference, Central
Illinois Section, Peoria, Ill., 18-20 Apr 1977.
Availability: SAE

HS-024 085

CHARACTERISTICS OF ACTIVATED CARBON FOR CONTROLLING GASOLINE VAPOR EMISSIONS--LABORATORY EVALUATION

The application of activated carbon for control of gasoline vapor emissions in service station operations was investigated under laboratory conditions. Cyclic tests were conducted on five activated-carbon materials at various combinations of temperature, humidity, fuel volatility, and container shape to

determine working capacity characteristics. Regeneration of the carbon was effected by air purging and vacuum stripping. Activated carbon presaturated with gasoline vapors was tested for recovery, and a 1000-cycle test was conducted to investigate longevity and heel composition. Laboratory data were projected to facilitate sizing of activated-carbon beds for a typical 50,000-gal/mo service station. The gasoline vapor working capacity of activated carbon varied directly with the true vapor pressure of the gasoline and was lower with unleaded gasoline vs. leaded gasoline of the same RVP (Reid vapor pressure). Marked differences in working capacity may be observed between different manufacturing batches of activated carbon and between different product types. Such properties as carbon tetrachloride activity provided a fairly good indication of relative performance with gasoline vapors. Carbon working capacity varied directly with ambient temperatures in tests using a constant RVP gasoline. Higher relative humidity in the charge vapor reduced carbon working capacity. High air purge strip rates did not increase carbon working capacity, but proportionately reduced stripping time. Heated air stripping resulted in only minor increases in working capacity. The working capacity of activated carbon varied directly with bed temperature during vacuum stripping provided that the carbon was allowed to cool down prior to successive charging with vapors. Hydrocarbon bleedthrough during charging of the bed with vapors was more prevalent when vacuum stripping was used than with countercurrent flow air purging. Degradation in working capacity for 1000 cycles of operation was approximately 29%. Activated carbon presaturated with gasoline vapors was restored to over 50% of its normal working capacity with one stripping mode and to approximately 75% within 21 normal working cycles.

by Michael J. Manos; Warren C. Kelly; Max Samfield
Scott Environmental Technology, Inc.; Environmental
Protection Agency
EPA-68-02-2140
Rept. No. SAE-770621; 1977; 12p 6refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun
1977.
Availability: SAE

HS-024 086

SURVEY OF SERVICE STATION FUEL TEMPERATURES

In order to better understand the relationship of gasoline temperatures to hydrocarbon vapor emissions during vehicle fueling operations, the American Petroleum Inst. conducted a one-year gasoline temperature survey at 56 service stations located throughout the U.S. Data collected by Radian Corp. during all seasons of the year included such items as station throughput, physical characteristics of sites, meteorological data, and product temperatures from four locations (the bulk delivery transport tank, the underground storage tank, the service station dispenser, and the vehicle fuel tank). A preliminary interpretation of the survey results indicates that on an annual basis, temperature conditions favoring vapor shrinkage during vehicle refueling occur more frequently than conditions favoring vapor growth. For all stations tested, vehicle tank product temperatures exceeded dispensed temperatures in 66% of the vehicle refuelings, indicating vapor shrinkage. A seasonal dependence was shown with conditions for vapor shrinkage prevailing about 75% of the year, predominating during the warmer months when ambient temperature exceeded 50 degrees F. Dispensed product temperatures were shown to vary over a wide range with the average of all stations being

66.8 degrees F. This average is not weighted for throughput volume and is strictly the average of the reported data for the stations reporting over the test period and should not be construed to represent a national average.

by H. E. Harris
Exxon Co., API Vapor Emissions Task Force
Rept. No. SAE-770622; 1977; 10p 2refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun
1977.
Availability: SAE

HS-024 087

A STUDY OF VISIBLE SMOKE REDUCTION FROM A SMALL TWO-STROKE ENGINE USING VARIOUS ENGINE LUBRICANTS

Acceleration and steady-state tests were conducted to investigate the effect of various engine lubricants on the exhaust emission levels of a small two-stroke engine (motorcycle engine), in particular the effect of engine oils containing polybutene. These tests indicated that polybutene-containing oils produce less visible smoke than conventional two-cycle lubricants. Addition of certain diluents contributed to the reduction of smoke during acceleration tests, and the combined use of polybutenes and these diluents produced the least smoke. The higher aromaticity and the higher flash point diluents produced more smoke. During steady-state tests, the molecular weight of polybutenes exerted no influence on smoke, but during acceleration tests higher molecular weight polybutenes gave less smoke. Although gaseous hydrocarbon emissions were not affected by engine lubricant composition or its ratio to fuel, particulate emissions varied with these factors (the less oil, the less particulates and steady-state smoke). Polybutene-containing oils gave less particulates than mineral oils alone. About 95% of particulates collected were unburned lubricants, which accounted for visible smoke. Oils with high molecular weight polybutene produce less smoke in acceleration tests presumably because the higher viscosity of the polybutene maintains large oil droplet size and thereby retards the atomization of the oil. Large oil droplets will easily adhere to the surface of crankcase or muffler. Under abruptly-accelerating conditions, engine oil is fed quite richly, without enough residence time and temperature for it to burn cleanly, so that the degree of oil atomization would be responsible for smoke level. At steady-state, the thermal instability of polybutene itself would contribute to reducing unburned oil, and therefore smoke, irrespective of its molecular weight. It was confirmed by thermogravimetric analysis that polybutenes decompose more easily than mineral oils, resulting in reduction of visible smoke and oil mist emissions. Oil mist can pollute water when used in outboard motors, and can poison catalytic converters. It is noted that using polybutene oils could reduce smoke as well as a decreased fuel/oil ratio without deteriorating antiscuff performance.

by Kensuke Sugiura; Mineo Kagaya
Nippon Oil Co., Ltd. (Japan)
Rept. No. SAE-770623; 1977; 14p 4refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun
1977.
Availability: SAE

RIDE AND HANDLING DYNAMICS OF ROAD VEHICLES (A REVIEW OF RECENT LITERATURE)

A brief background of research in ride and handling dynamics of road vehicles is followed by a more detailed consideration of recent contributions on the subject and a brief discussion of trends in the field. The literature reviewed is grouped according to ride quality (vehicle design, measurement of ride quality, human response, evaluation techniques) and handling (tires, bicycles, automobiles, trucks). Overall, the primary feature of ride quality studies is the use of data processing techniques, not only in on-line (or quasi-on-line) data processing, in which large volumes of experimental data are manipulated to yield desired information, but also in design-oriented computer studies. On-line data processing relies largely on random process analytic techniques; design-oriented studies require extensive mathematical modeling of the engineering processes involved. Another recent development is ISO (International Standards Organization) 2631, a standard related to human exposure to whole-body vibration. Tire behavior, especially transient behavior, has dominated handling studies in recent years.

by F. D. Hales

Publ: Shock and Vibration Digest v10 n3 p3-8 (Mar 1978)
1978; 59refs

Availability: See publication

HS-024 089

SLOW TRAFFIC AND TRAFFIC SAFETY (LANGZAAM VERKEER EN DE VERKEERSVEILIGHEID)

A statistical description of pedestrians, bicyclists and moped riders killed in traffic in the Netherlands from 1968 to 1972 was sponsored by the Government Steering Committee for Slow Traffic. Variables considered are demographic factors (sex and age), residence characteristics (province, inside or outside of built-up areas and number of inhabitants), situation factors (location on the roadway and collision object), other circumstances (month of the year, day of the week, time of day, and weather and illumination conditions), and the severity of the accident. Among pedestrians, bicyclists and moped riders killed in traffic accidents, the number of men is far larger than that of women; the smaller the number of inhabitants in a community, the larger the number of slow-traffic fatalities per 100,000 inhabitants. Among pedestrians killed, the age categories of 0-9 years and 60 years and older are heavily represented; among bicyclists, age categories 10-19 and 60-older; among moped riders, age category 10-19. Most pedestrian fatalities occur on straight roads; bicycle and moped fatalities are more uniformly divided between straight roads and intersections, both in and outside built-up areas. The collision object is primarily cars, followed in frequency by trucks. Pedestrians seem to be killed primarily on Friday; bicycle fatalities are spread over the days of the week, excepting weekends and holidays. For moped riders no significant difference is found among the days of the week. Most slow-traffic victims suffer accidents in the period 1630-1830 (4:30-6:30 pm). At dusk and at night a significant portion of the pedestrians and bicyclists killed are in the age category 60 or older; among moped riders at dusk or at night the age category 10-19 is most heavily represented among fatalities. The most common injuries among all traffic participants are head injuries,

followed by leg injuries. A series of statistical tables provide detailed analysis of the findings.

by J. H. Kraay

Stichting Wetenschappelijk Onderzoek Verkeersveiligheid (SWOV), Voorburg, Netherlands
Rept. No. R-76-4; 1976; 121p 29refs
Translation from Dutch (original text 65p; translation 56p).
Availability: Reference copy only

HS-024 090

MOPED ACCIDENTS, MOPED WEIGHT AND MOPED TYPES (KNALLERTUHELD, KNALLERTVAEGT OG KNALLERTTYPER)

On the basis of material collected by the Copenhagen Police, the Danish Structural Office and the Council for Traffic Safety Research, a study was made of moped accidents in relation to moped traffic, moped weight and moped models. Accident involvement of mopeds corresponds to their proportions in traffic, with no weight class or type particularly accident-prone. The data do not permit an evaluation of whether mopeds with illegal structural modifications ("bored out" mopeds) are more frequently involved in accidents, but there is a tendency for bored-out mopeds to be involved in a relatively greater number of speed-related accidents. The drivers of light mopeds suffer more severe injuries than the drivers of heavy mopeds. There is a tendency toward more leg injuries and fewer head injuries in drivers of the heaviest mopeds in comparison to those of lighter mopeds; drivers of heavy mopeds use crash helmets more consistently, but the significance of this difference cannot be clearly established. Illegal structural modifications are found overwhelmingly in the heavy mopeds, especially in the 50-60 kg. weight class. Drivers of the lighter mopeds tend to commit the most violations and their machines have more technical defects, such as defective brakes. Since increased speed at the time of an accident is assumed to be an injury-associated factor, technical measures and changed speed limits which permit higher speeds may lead to more serious accidents. The study shows the probability of an approximately identical risk in driving mopeds of various weight classes; therefore the safety significance of limitations on weight depend on how a weight limit affects the entire range of vehicles. A weight limit of 50 kg dead weight (excluding fuel, or approximately 55 kg including fuel), will cover the majority of all illegal structural modifications and the majority of unnecessarily noisy mopeds.

by N. O. Joergensen; Frank Brodersen; H. V. Lund
Radet for Trafiksikkerhedsforskning, Akademivej, bygning 371, 2800 Lyngby, Denmark
Rept. No. Bull-146; 1976; 70p
Translation from Danish (original text 40p; translation 30p).
Availability: Reference copy only

HS-024 091

ALL-WEATHER CHASSIS DYNAMOMETER FACILITY

The Amoco "all-weather" chassis dynamometer (AWCD) facility in Naperville, Ill. which began useful operation in Oct 1976, is a closed-circuit, single-return, semi-open jet wind tunnel used primarily for automotive fuel and lubricant studies. Underhood temperature and loading conditions of cars operated on the road are accurately duplicated in the tunnel.

Maximum vehicle and air speed is 145 kph (90 mph); maximum loading is 235 kW (315 hp). Two soak rooms adjacent to the tunnel are used to temperature-condition cars for testing in the tunnel, to conduct static car tests, or to perform engine-dynamometer studies. Temperature and humidity in the tunnel and soak rooms are controlled independently from -40 degrees C to 49 degrees C (-40 degrees F to 120 degrees F) and from essentially dry to essentially saturated air.

by B. D. Keller; J. H. Steury; M. R. Betry; P. J. Clark
Amoco Oil Co., Res. and Devel. Dept.; Standard Oil Co., Res. Dept.; Dilworth, Secord, Meagher, and Associates Ltd., Toronto, Ont., Canada
Rept. No. SAE-770626; 1977; 18p 8refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 092

SELLING AN IDEA: GRAPHITE'S DAY IS COMING [GRAPHITE FIBER COMPOSITES FOR AUTOMOBILE COMPONENTS]

Although the extent of future use of graphite fiber composites in the manufacture of automobile parts still remains in doubt, Dept. of Transportation (DOT) figures obtained by querying the auto industry and its vendors indicate that the 1990 car will contain 90 lb of the composite. Since the fibers constitute only 20% of the automotive composite, with resin (50% by weight) and glass (30%) comprising the remainder, an average of 18 lb of graphite fiber would be used in each 1990 car. Based on a 10-million-car fleet, the total would be 180 million lb. The producers would have to multiply 1977 world capacity (slightly less than 3 million lbs) 60 times in the next decade to put that much of the high strength-high modulus, weight-saving material into vehicles sold only in the U.S. To keep automobile production costs down as they move toward lighter but more expensive materials, the car companies are trying to use more common components across the product lines. The potential for the graphite vendors is increasing with emphasis on larger suppliers able to commit the investments needed to fill larger orders. The question is whether the big order from the auto companies or the expansion of capacity by the vendors comes first. Also to be answered is whether the price commitment from the vendors will precede or follow signed orders from the auto manufacturers.

by Erwin Maus, 3rd.; Patricia J. Williams
Publ: Ward's Auto World v14 n7 p29-32 (Jul 1978)
1978
Availability: See publication

HS-024 093

A NOTE ON GOUGH STIFFNESS AND TREAD LIFE

A particular stiffness which pertains to the bending of a tire tread-band assembly in its own plane was defined by V. E. Gough (1968) who reasoned that it was the dominant constructional characteristic controlling tread life. Gough's stiffness computations have been a useful guide to the relative contributions and optimum values of major tire constructional variables such as rubber modulus, belt cord angle, cord modulus of elasticity, and cord count, (numbers of ends per inch), but a link has been missing between the stiffness and the tread life. Although the Gough theory predicts the dependence of the

stiffness on tire constructional variables, no relationship, empirical or theoretical, between these quantities appears to have been published. Such a relationship has now been derived from data recently made available by Agee et al., in a 1977 report, "Response of Radial Passenger Tire Treadwear to Reinforcement Cord Modulus."

by B. K. Daniels
Publ: Tire Science and Technology v5 n4 p226-31 (Nov 1977)
1977; 12refs
Presented at ASTM [American Society for Testing and Materials] Com. F-9 on Tires Symposium on Tread Wear, Akron, 10 Nov 1976.
Availability: See publication

HS-024 094

DEVELOPMENT OF WIRE-EXPLOSION-SPRAY COATED CYLINDERS FOR MOTORCYCLE ENGINES

A new type of aluminum alloy cylinder for motorcycle engines is reported, whose piston sliding surface is coated with a hard, metallic coating which is formed by alternately exploding molybdenum and piano wires onto the bore surface of the cylinder. In a series of tests comparing the wire-explosion-spray-coated cylinder (WESC cylinder) with a cylinder having a special cast iron sleeve impregnated with graphite (CISI cylinder) and another cylinder with porous chrome plating, the WESC cylinder was found to be much superior in seizure resistibility to either of the other two. Because of this characteristic, the cylinder can be used with a lean air/fuel mixture, effecting a reduction in fuel consumption and emissions. Piston slapping noise can be reduced as a result of maintaining smaller piston to cylinder clearances and the coating has excellent strength and durability characteristics.

by Hideaki Kuse; Makoto Ohtsu; Hiroshi Ito; Shusuke Takezaki
Kawasaki Heavy Industries, Ltd., Japan; Nippon Tungsten Co., Japan
Rept. No. SAE-770624; 1977; 12p 3refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 095

AUTOMATED ACQUISITION AND REDUCTION OF ENGINE LUBRICANT TEST DATA

An automated data acquisition and reduction system has been in continuous operation for five years at Southwest Res. Inst., San Antonio, Tex., dedicated to assisting in the processing of diesel engine lubricant evaluations. The data handling system is basically composed of two minicomputers and supporting devices that perform the functions of data logging (DAS, Data Acquisition System) and data processing (SDS, Software Development System). The SDS serves as a ready back-up to the DAS to ensure minimal risk of any significant downtime. The dual-processor concept (DAS/SDS) has provided the flexibility sought initially and has allowed the system to perform routine data logging as well as engineering tasks without penalties to either assignment. Many diagnostic programs have been developed, resulting in better test operational control and increased understanding of engine operation. Continued developmental work is underway to discover more applications of

computer use in engine lubricant testing as well as other engineering tasks, including routine clerical documentation.

by J. A. Vitkovits; T. R. Jackson; J. R. Siefert; P. R. Lepisto
Southwest Res. Inst., P.O. Drawer 28510, San Antonio, Tex.
78284

Rept. No. SAE-770625; 1977; 18p 6refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun
1977.

Availability: SAE

HS-024 096

TREAD LIFE OF ORIGINAL EQUIPMENT RADIAL TIRES

A nationwide survey (24 cities within the contiguous 48 states, and Fairbanks, Alaska) of original equipment tires (80% of which are radials) was made by the Test Operations Dept. of the Uniroyal Tire Co. in Jun 1976. Each tire, exclusive of spares, was gauged for tread depth at two circumferential locations in three grooves (inner shoulder, center, and outer shoulder). The corresponding odometer reading was recorded. Using the mean regression line technique, the merged brands, sizes, and locations gave a tread life expectancy of 38,000 mi (61,155 km). Tire life expectancies from constituent locations (excluding Fairbanks) revealed a national pattern of variation from 32,000 mi to 50,000 mi (51,500 km to 80,465 km). The geographic distribution of tread life expectancy for radial passenger tires surveyed in 1976 is charted on a U.S. map for comparison with a second map (lines of constant tread life in thousands of miles) of tread life expectancy for belted passenger tires surveyed in 1970. The principal difference between the 1976 and the 1970 surveys is in the mean value, 27,000 mi (43,450 km) for the latter vs. 38,000 mi for the former. More striking, however, are the similarities in the location of the low values over the Appalachian and Western mountains and the high value ridge connecting the Great Lakes and the Gulf of Mexico via the Mississippi Valley. High values on the Pacific Coast are also common to both maps. Tentative investigations of other sources of variation in tread life expectancy include those among brands and between front and rear wheel positions. The latter cause of variation can be examined via the screened file of fixed position items. (This constituted 48% of the total of fixed and rotated items.) Paired comparisons on this subset of data suggest that tires operating in rear wheel positions have about 27% greater tread life expectancy than their front wheel companions. Although faster wearing front tires are normal for most drivers, only 52% of those tires that appeared to be original placements showed evidence of having been rotated. The more rigorous service of front wheel positions limits the range of brand variation to 8%; in rear wheel service, the best brand performance was 19% greater than the worst.

by B. W. Root

Publ: Tire Science and Technology v5 n3 p127-35 (Aug 1977)
1977; 1ref

Presented at ASTM Com. F-9 on Tires Symposium on Tread
Wear, Akron, 10 Nov 1976.

Availability: See publication

HS-024 097

ENERGY LOSS IN AN ANALYTICAL MEMBRANE TIRE MODEL

Energy dissipation is calculated from the contact deformation of a rolling toroidal membrane tire model. The method of dissipation analysis developed can be used with other structural representations, including those based on the finite-element method. The membrane tire model is inflated, loaded, and rolled on a frictionless, flat surface. The membrane material is assumed to be isotropic and neohookean under static loads and to exhibit a low loss tangent. The assumption of a low loss material permits viscoelastic power loss to be calculated from load transfer functions derived from the elastic response of the tire model. The power loss calculation is used to predict rolling resistance and contact patch shift.

by J. T. Tielking; R. A. Schapery

Publ: Tire Science and Technology v5 n3 p136-51 (Aug 1977)
1977; 11refs

Presented at ASTM Com. F-9 on Tires Symposium on General
Subjects, Cleveland, 19 May 1976.

Availability: See publication

HS-024 098

A NOTE ON THE ACCURACY OF CALIBRATION OF A FIFTH WHEEL

A series of experiments was conducted to investigate the effects of speed and method of test on the accuracy of calibration of a fifth wheel. Three methods of running a calibration test were examined: align the vehicle with respect to the zero distance marker, set the vehicle in motion, accelerate to the desired speed as quickly as possible, then, near the end of the measured mile, slow down and align the vehicle with respect to the mile marker as it was at the zero marker, according to ASTM (American Society for Testing and Materials) Standard Method for Speed and Distance Calibration of a Fifth Wheel Equipped with Either Analog or Digital Instrumentation (F 457-76); accelerate gradually up to the desired speed over the first half mile, then decelerate gradually over the remaining half mile, coming to a stop at the mile marker; and run the total distance at the desired speed, using an external signal to start and stop the measuring equipment. Three speeds, 30 mph, 40 mph, and 50 mph (48 kph, 64 kph, and 80 kph) were used in each procedure. There were no statistically significant differences among the test procedures, but the results were strongly dependent on the test speed. Results were best at the test speed of 30 mph (the same as the calibration speed) and deviated most at 50 mph. It is also noted that the error in these tests was much less than the maximum allowable system error (plus/minus 0.1%). For the measurement of long-distance road courses, the best calibration might be a speed near the average of the course speed. For example, if over a 100-mi (161-km) course the average speed is 42 mph (68 kph), it is suggested that the fifth wheel be calibrated at 40 mph (64 kph).

by Harry Williams

National Hwy. Traffic Safety Administration, Washington,
D.C. 20590

Publ: Tire Science and Technology v5 n3 p152-4 (Aug 1977)
1977

Availability: See publication

HS-024 099.

WORKING TIPS: RACK AND PINION SERVICE

Some information about and tips for working on rack and pinion steering systems are presented for the automotive service specialist. The basic design of a representative rack and pinion steering gear assembly is described. Procedures are outlined for making two in-service adjustments (on rack damper and on pinion bearing preload). Several operational checks (e.g. amount of play at the rim of the steering wheel,) and common repairs, such as replacement of spindle connecting rod ends and adjustments to bellows-type seal between gear housing and inner end of spindle rod(s) are discussed briefly. Several variations of the basic rack and pinion steering gear are described, such as the power boost option and the variable ratio gear assembly.

by Herb Carrier

Publ: Brake and Front End v48 n9 p43-6, 48-9 (Sep 1978)
1978

Availability: See publication

HS-024 100

FLYWHEEL/DIESEL HYBRID POWER DRIVE: URBAN BUS VEHICLE SIMULATION. FINAL REPORT

A flywheel/diesel hybrid power drive configuration for urban transit bus application is investigated, using a computer simulation model. The hybrid uses continuously variable ratio transmissions and a control subsystem to optimize fuel consumption in an "on-off" mode of engine operation. The subsystem is a moderately sized diesel engine in series with a relatively large flywheel. A friction clutch is incorporated between the engine and the flywheel, with a continuously variable ratio transmission between the flywheel and the rear axle drive wheels. The system is projected to use 50% less fuel than a diesel-alone in urban driving cycles having more than four stops per mile. Regenerative braking is used, contributing to fuel consumption improvement. The computer simulation model developed as a major tool for this investigation is described in detail. Appended are a review of previous flywheel and heat engine studies, a review of selected power drive subsystem components and flywheel sizing, graphs showing engineering limit performance of transit buses over urban drive cycles, a glossary of the computer program nomenclature, and the program listing for the computer simulation model.

by Glenn S. Larson; Harry Zuckerberg

Transportation Systems Center, Kendall Square, Cambridge, Mass. 02142

Rept. No. UMTA-MA-06-0044-78-1; DOT-TSC-UMTA-78-10; 1978; 222p 16refs

Rept. for Oct 1976-Oct 1977. Sponsored by Urban Mass. Transportation Administration.

Availability: NTIS

HS-024 101

LOW LIFE CYCLE COST DESIGN STUDY FOR PARATRANSIT VEHICLES. FINAL REPORT

Redesign of the original prototype of the AMF Paratransit vehicle (PTV) to achieve low life cycle cost for projected low volume production rates is described. After a preliminary

design review, resulting in revised vehicle specifications and assessments of the systems, components, and repair and maintenance, a final selection is presented of an optimum design based on low life cycle costs. Cost estimates are given for the major elements of life cycle costing including manufacturing, maintenance and repair costs. It is concluded that a paratransit vehicle, with all the special features of this design, could be built for \$7,800 and utilized over its extended service life at a net cost to the operator that would be less than that of a conventional taxi-cab. With a service life of 350,000 miles, the PTV will have a depreciation of 2.2 cents per mile (20% less than commercial taxi rate). Fuel economy (15.5 mpg) for the urban cycle is about double the conventional taxi rate. Maintenance and repair costs are estimated at 5.1 cents per mile. Further study to quantify other cost factors is recommended.

by J. A. Bartol; J. G. Bishop

ASL Engineering, Inc., 495 South Fairview Ave., Goleta, Calif. 93017

DOT-TSC-1351

Rept. No. UMTA-MA-0052-78-6; DOT-TSC-UMTA-78-14; 1978; 204p 13refs

Rept. for Apr-Nov 1977.

Availability: NTIS

HS-024 102

USES OF FEEDBACK IN COMPUTER-ASSISTED INSTRUCTION IN DEVELOPING PSYCHOMOTOR SKILLS RELATED TO HEAVY MACHINERY OPERATION

A study was performed to determine the relative effectiveness of different formats of computer-assisted instruction (CAI) in teaching a psychomotor performance task. A control group combining male and female subjects received instruction based on the study of written materials and unstructured practice sessions on a heavy transmission gear-shifting task. No significant differences were found between male and female performance patterns and learning abilities under control conditions. Two experimental groups, both restricted to males, were trained under similar practice conditions with the addition of computer monitoring of performance and feedback of supplemental information to the students. One group received terminal feedback of numerical performance quality scores following each trial. The other group received continuous feedback of an analytic display (a display of nominal road speed against elapsed time in the form of an X-Y plot) concurrent with each trial. Both experimental groups were tested for retention of skills after transitioning to a non-feedback performance environment. Both forms of CAI proved to be significantly superior to the control teaching procedure. It is felt that in both cost and effectiveness, a CAI system of psychomotor instruction could be a match for many one-to-one instruction procedures involving close supervision, and would be superior to almost any classroom environment with unsupervised practice.

by Jeffrey R. Phillips; Jan Berkhout

DOD-DAHC-19-75-G-009

Publ: Human Factors v20 n4 p415-23 (Aug 1978)

1978; 8refs

Availability: See publication

HS-024 103

DICKINSON COUNTY COMMUNITY SCHOOLS TRAFFIC SAFETY EDUCATION CURRICULUM EVALUATION. FINAL REPORT

Consultation was provided to the Kingsford, Mich. school district in planning an evaluation program to determine the effectiveness of a grade 7-9 traffic safety evaluation curriculum guide when integrated into selected areas of the junior high curriculum. Assistance was provided in four areas: establishing the overall research evaluation design and methodology, and specific evaluation procedures; offering guidance and conducting workshops in the preparation of lesson outline, lesson plans and tests; review of teacher prepared lesson plans and tests; development, review, and revision of tests and test procedures. The resulting package of lesson plans, evaluation plans and evaluation instruments (tests) ready for implementation into the school curriculum is presented in the appendices.

by Thomas L. McDole
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,
Mich. 48109
Rept. No. UM-HSRI-77-34; 1977; 76p 2refs
Rept. for 1 May 1976-30 Jun 1977. Sponsored by Dickinson
County Community Schools, Roosevelt School, Kingsford,
Mich. 49801.
Availability: Corporate author

HS-024 104

THOSE AMAZING SUPER GLUES [INDUSTRIAL APPLICATIONS OF ADHESIVES]

By altering the structure of molecules, scientists have devised hundreds of new chemicals that can bond almost any two solids; synthetic polymer adhesives are transforming the manufacture of a vast array of products. It is expected that in 1978 the U.S. will consume 5 million tons of adhesives worth \$1.5 billion, and it is predicted that adhesive sales will continue to grow at a 6.4% annual rate. Spurred by the need to cut weight, reduce aircraft fatigue, and lower costs, airplane manufacturers have been steadily expanding the use of adhesives for 30 years; epoxy is now used for high-stress joints. Among other specialty adhesives is cyanoacrylate, the "instant" adhesive found on consumer shelves under such names as "Krazy Glue," "Permabond," and "Super Glue." Although not as durable as epoxy and extremely costly, cyanoacrylate bonds almost any nonporous material to any other, can cure in as little as ten seconds, and requires no mixing. It is employed mainly in the manufacture of electronic components. Another remarkable chemical is the anaerobic adhesive, a polyester resin that, unlike most liquids, remains fluid only while it is exposed to air. The anaerobics are ideal for machine assembly because they do not cure until the parts are joined and because they prevent leakage and loosening when the assemblage is subjected to vibration. In the auto industry alone, anaerobics are being used in only 25% of their potential applications. Loctite currently commands about 85% of the anaerobic market but soon will face some heavy competition from 3M and National Starch. Despite the technical advantages and lower costs (especially in labor), adhesives still face enormous obstacles. Careful and skillful preparation of surfaces is usually required before an adhesive is applied, and so far the development of application equipment has lagged behind the proliferation of new adhesives. The Environmental Protection Agency and the Occupational Safety and Health Administration regulations are also concerned with the safety

of the chemicals involved in formulating adhesives. Underlying all these tangible obstacles is the intangible human suspicion about the efficacy of chemical fasteners. The auto industry is expected to provide a big future market due to the use of more plastic and lighter metals which will need more adhesives. Eventually adhesives will be developed that will work in the less-than-spotless environment of the assembly line; already an acrylic adhesive that penetrates grease and sticks to the metal below is being used to bond the inner and outer panels of engine hoods. Looking further in the future, the age of composites is approaching, where adhesive assembly is a necessity. Composites can provide light weight, rigidity, and in some cases insulation against heat and sound.

by Peter Nulty
Publ: Fortune v98 n6 p98-9, 100, 104 (25 Sep 1978)
1978
Availability: See publication

HS-024 105

PRIORITY TREATMENT FOR HIGH OCCUPANCY VEHICLES IN THE UNITED STATES: A REVIEW OF RECENT AND FORTHCOMING PROJECTS. FINAL REPORT

Recent high occupancy vehicle (HOV) preferential projects in the U.S. are described, the results of these projects summarized, implications drawn, and projects outlined for implementation over the next few years. The following approaches to preferential treatment are described: non-separated concurrent-flow freeway HOV lanes, contra-flow freeway lanes, metered ramp bypass lanes and exclusive ramps, physically separated priority lanes, express bus service and park-and-ride lots, lanes on arterials and central business district (CBD) streets reserved for buses, bus priority signal systems on arterials and CBD streets, transit malls, and auto restricted zones. By the middle of the 1970's, transportation planning had moved away from costly capital intensive priority treatments requiring extensive new construction to more operationally oriented traffic management schemes that use existing facilities more efficiently. Except for the non-separated concurrent flow projects, other non-capital intensive priority treatments on freeways have fared well. Nearly every HOV priority treatment on freeways has involved the use of new or expanded express bus service and the opening of new park-and-ride lots. Arterial and CBD street bus lanes have been implemented in many cities and transit malls have grown in popularity. Four auto restricted zones are to be built during the next few years, in New York, Memphis, Providence and Boston.

by Ronald J. Fisher; Howard J. Simkowitz
Transportation Systems Center, Kendall Square, Cambridge,
Mass. 02142
Rept. No. UMTA-MA-06-0049-78-11; UMTA-78-37; 1978; 36p
19refs
Rept. for 1974-1980. Sponsored by Urban Mass Transportation
Administration. UMTA/TSC Proj. Evaluation Series.
Availability: NTIS

HS-024 106

MOTORCYCLE RIDERS AND ALCOHOL -- A PROBLEM?

The absence of uniform accident reporting systems in the U.S. prevents accurate determination of the extent of alcohol involvement in motorcycle accidents. Alcohol is involved in from 3% to 6% of all motorcycle accidents, and in between 40% and 50% of all motorcycle fatalities. Single vehicle motorcycle accidents and fatalities show a higher percentage of alcohol involvement than multiple-vehicle motorcycle accidents. More research and accident data analysis is needed, based on an improvement in the uniformity of accident report systems.

by Roger P. Quane

Publ: MSF: On the Move v4 n3 p3 (Aug 1978)
1978

Availability: See publication

HS-024 107

EXHAUST EMISSIONS, FUEL CONSUMPTION AND TRAFFIC: RELATIONS DERIVED FROM URBAN DRIVING SCHEDULE DATA

Traffic variables were calculated from the defining speed-time history of the LA-4 fixed urban driving schedule (the basis of the Federal Test Procedure (FTP) used by the Environmental Protection Agency to estimate official emissions and city fuel economy). Calculations were made for each of the 18 stop-to-stop cycles which comprise this schedule, in a manner similar to that previously applied to field data. The following nine variables were analyzed: average trip time per unit distance; average trip speed; stops/km; largest instantaneous deceleration, or braking, during the cycle; largest instantaneous acceleration during cycle; acceleration noise; work performed per unit distance to accelerate the vehicle; fraction of time spent stopped; and fraction of distance traveled "coasting or braking". Inter-correlations among the variables were examined. The ability of the traffic variables to explain emissions and fuel consumption was examined using data from 12 cars run on FTP dynamometer tests. It was found that hydrocarbon emissions can be expressed as a linear function of average trip time per unit distance for low-speed urban driving. Variables that are more difficult to measure for actual traffic are required to calculate carbon monoxide (CO) and nitrogen oxides (NOx) emissions. The dynamic variable that best explains NOx and CO is the work performed per unit distance to accelerate the vehicle. Speed characteristics, alone, through their correlations with acceleration characteristics might provide an adequate description of CO and NOx emissions for a more extensive data set. A single FTP test can yield data from which a vehicle's fuel consumption at any urban speed can be estimated.

by Leonard Evans

General Motors Res. Labs., Traffic Science Dept., Warren,
Mich. 48090

Rept. No. GMR-2599; 1977; 38p 16refs

Availability: Corporate author

HS-024 108

FUEL CONSUMPTION AND RIGHT TURN ON RED: COMPARISON BETWEEN SIMPLE MODEL RESULTS AND COMPUTER SIMULATION

It is shown that once the change in the average speed in a traffic system has been determined, the change in fuel consumption can be immediately derived, using a simple model of the dependence of urban fuel consumption on average traffic speed, without the necessity of performing fuel summation. Fuel economy and speed information from a recent study by Lieberman and Cohen which calculated the effect on fuel economy and emissions of permitting a right turn on red at signalized intersections, is used to illustrate the application of the model. These researchers applied a detailed computer simulation to a network of streets in Washington, D.C. and obtained fuel consumption by adding up the fuel used to execute each individual maneuver. Agreement is found between the simulation results and the model derived from actual driving in urban traffic. As an alternative to a detailed calculation based on individual vehicle trajectories, this model provides a simple method for evaluating changes in fuel consumption associated with various operating policies in urban traffic in cases where the effect on mean speed can be estimated by simulation or other means.

by Man-Feng Chang; Leonard Evans; Robert Herman; Paul Wasielewski

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Rept. No. GMR-2094; 1976; 7p 5refs

Availability: Corporate author

HS-024 109

BICYCLE-SAFE GRATE INLETS STUDY. VOL. 2--HYDRAULIC CHARACTERISTICS OF THREE SELECTED GRATE INLETS ON CONTINUOUS GRADES. FINAL REPORT

Additional tests were conducted on three grate inlet designs that were identified in an earlier study (Vol. 1, FHWA-RD-77-24) as being bicycle-safe, hydraulically-efficient, and able to handle debris. The three grate inlet designs are a fabricated steel parallel bar grate with a 3/4 in (19 mm) clear spacing between bars, a fabricated steel parallel bar grate with transverse rods on 4 in (102 mm) centers at the surface, and a cast iron grate with transverse curved vane bearing bars. The purpose of the additional tests was to broaden the available design data for grate inlet widths from the 2 ft (0.61 m) width of the previous study to include widths of 1.25 ft (0.38 m) and 3.0 ft (0.91 m). The following four full-scale grate inlet sizes were tested: 1.25 ft by 2.0 ft (0.38 m by 0.61 m), 1.25 ft by 2.67 ft (0.38 m by 0.81 m), 3.0 ft by 2.0 ft (0.91 m by 0.61 m), and 3.0 ft by 4.0 ft (0.91 m by 1.22 m). Hydraulic-efficiency tests were conducted at cross slopes of 1/48, 1/24, and 1/16 and longitudinal slopes of 0.5%, 1.0%, 2.0%, 4.0%, 6.0%, 9.0% and 13% with gutter flows up to 5.6 cu ft/sec (0.158 cu m/sec). In general, for the high-energy gutter flow conditions, the parallel bar grate with spacers and the curved vane grate were more efficient than the parallel bar grate with transverse rods. For low-energy gutter flow conditions, the curved vane grate was normally somewhat less efficient than the fabricated steel

grates. Numerous design curves were developed to aid the hydraulic design engineer with grate inlet selection.

by P. H. Burgi
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FHWA-PO-5-3-0166
Rept. No. FHWA-RD-78-4; 1978; 158p
Availability: NTIS

HS-024 110

REDUCING NO_x EMISSIONS [NITROGEN OXIDES, JAPANESE CARS]

Japanese auto manufacturers have cut NO_x (nitrogen oxides) emissions to meet the country's 1978 emission regulations of 0.25 g/km, while maintaining specific fuel consumption (sfc) at reasonable levels. The changes made to the Honda CVCC engine for 1978 were aimed at maintaining an air-fuel ratio (A/F) of 19.5:1 while gaining a slight improvement in performance. Honda's solution was to reduce the area of the throat of the auxiliary chamber that leads to the main combustion chamber, and to alter the pattern of the flame torch. To improve atomization of the very lean mixture in the main carburetor, an air bleed has been added, while the dual venturi has been replaced by a triple venturi. Driveability has been improved by the addition of an accelerator pump actuated by manifold depression. Control of the preheating of the mixture has also been improved. The ignition timing has been retarded slightly, the valve lift has been increased from 9.7 mm to 10 mm, and the inlet closure point extended by 2 deg. At a steady 40 kph, the changes to the engine have resulted in a reduction of NO_x emissions of 35%, from 1.26 g/kWh to 0.87 g/kWh. At the same time, the fuel consumption on the Japanese 10-mode cycle has been improved from 7.14 liters/100 km to 6.9 liters/100 km. Since the Nissan fast-burn engine, in which there are dual spark plugs, represents a minor change in design, its results are quite remarkable. Nissan claims that the stability limit at an A/F of 14.5:1 is reached with 33% EGR (exhaust gas recirculation) instead of with 20% as in the previous design. At a certain road-load condition, the sfc is quoted as 0.39 kg/kWh at 20% EGR, compared with 0.43 kg/kWh for the previous design at the same level of EGR. Owing to faster combustion, NO_x emissions are higher, with little or no EGR. With Toyota's TGP system in which the spark plug is in the throat between the generating pot and the main chamber, the misfire limit is in the 21:1 to 24:1 A/F range, according to load and speed. In practice, 15% EGR is acceptable and the misfire limit is quoted as 20:1 gas:fuel ratio at road-load conditions. Owing to a leaner mixture in the TGP engine, fuel consumption has improved by 7% to 8% on the Japanese 10-mode test and by 17% at a steady 60 kph. With Mitsubishi's MCA-Jet system, the engine can operate at an A/F of 18:1 as the optimum for driveability and 20:1 for fuel consumption, and can operate with 25% EGR and advanced ignition timing. It is claimed that the fuel consumption on the 10-mode cycle has improved by 27%, 17% in normal mixed driving. The minimum sfc is 0.41 kg/kWh at 40 kph, although it increases to 0.446 kg/kWh with 10 g/h NO_x emissions.

by John Hartley
Publ: Automotive Engineer v3 n4 p68-70 (Aug-Sep 1978)
1978; 1ref
Availability: See publication

HS-024 111

ANALYSIS OF TORSIONAL VIBRATION OF AN AUTOMOTIVE GEARBOX

An investigation was undertaken to establish the degree of complexity and refinement required for a mathematical model of an automotive gearbox to allow accurate prediction of its torsional vibration characteristics. Research on vibration characteristics of automotive drivelines has been extensive, with few reports of studies concerned solely with the gearbox. Several methods for the analysis of torsional vibration characteristics of multi-mass systems (two-mass system, multi-mass system - Holzer analysis, multi-mass system - matrix analysis) were utilized to study the characteristics of a Chrysler Avenger gearbox, a conventional manually-controlled unit providing four forward speeds plus reverse. Comparison of analytical results with laboratory measurements indicated that a simple two-mass model yields satisfactory results for the determination of the fundamental natural frequency of torsional vibration. In the case of higher frequencies, a more complex mathematical model becomes necessary. A model based on matrix methods seems most appropriate for the analysis of a branched system such as an automotive gearbox. Refinement of the matrix by incorporating factors such as shaft inertia and gear-tooth stiffness produces a relatively small improvement in the results.

by T. A. H. Pixton; R. Ali
Publ: Automotive Engineer v3 n4 p64-6 (Aug-Sep 1978)
1978; 10refs
Availability: See publication

HS-024 112

INLET MANIFOLD REQUIREMENTS FOR LOW EMISSIONS [SPARK IGNITION ENGINE]

A theoretical investigation was made of the manifold requirements of a spark ignition (SI) engine to produce a given level of liquid fuel evaporation, of the further evaporation processes during the compression and combustion periods, and of the effects of any remaining liquid fuel on the formation of unburned hydrocarbons (HC) and carbon monoxide (CO). The study was limited to a single-cylinder, air-cooled, side-valve engine. The relationship among the manifold length, temperature, and percentage evaporation of liquid fuel was traced, and the life history of the remaining liquid droplets was followed. It is concluded that for normal operation of SI engines, manifold heating cannot significantly vaporize the fuel droplets. Even at a manifold length of 0.5 m, a surface temperature of over 473 degrees K would be required for complete vaporization, and a manifold length of about 2 m would be required at more normal operating temperatures. Most fuel evaporation takes place inside the cylinder because of the heat transferred from the hot points of the cylinder bore and head and from the top surface of the piston. Fuel also evaporates continuously during compression because of the increasing mixture temperature. Nevertheless, evaporation before combustion is critical in improving HC emissions, and if fuel can be completely vaporized before ignition, it is possible to operate at peak performance with leaner overall mixtures, resulting in minimal CO emissions.

by D. J. Picken; H. A. Soliman; Malcolm F. Fox
Publ: Automotive Engineer v3 n4 p59-61 (Aug-Sep 1978)
1978; 7refs
Availability: See publication

HS-024 113

DETROIT DIESEL ALLISON EXPANDS IN EUROPE [GENERAL MOTORS' HEAVY-DUTY AUTOMATIC TRANSMISSIONS AND DIESEL ENGINES FOR EUROPEAN MARKET]

At the recent Detroit Diesel Allison (DDA) Division's four-day Transporama international exposition in Liege, Belgium, General Motors unveiled a new heavy-duty automatic transmission equipped with an integral hydraulic retarder developed specifically for the European market. Designated the MT-644, this new transmission is a 4-speed unit for diesel engines of up to 225 kW (300 hp) and 1055 Nm (778 lb ft) torque and is applicable to all types of commercial and public service vehicles up to 33 tons GVW (gross vehicle weight). Now being evaluated in European test vehicles, the integral retarder of the new MT-644 transmission utilizes both hydraulic and friction braking systems, combining an immersed wet clutch arrangement for high-speed downhill travel and to comply with European braking laws, and friction braking at low speeds to stop a vehicle completely. A modular unit fitted in place of the rear bearing retainer, the retarder will also be available for use with Allison MT-643 4-speed and MT-654 5-speed automatic transmissions. The most prominent features of the MT-644, whose gear ratios are tailored to complement European diesel engines, are its torque converter, planetary gearing, and hydraulic controls. DDA also announced the establishment in Rotterdam, Holland, of its first major facility on the mainland of Europe, an engineering, product application, and service training center with emphasis on heavy-duty highway and off-highway transmissions and diesel engines. A large increase in European sales is confidently predicted by DDA, which has a network of 43 distributors and 99 dealers strategically located throughout Europe. It is expected that within the next five years more than 30% of DDA's business will be international sales. Transmission sales are expected to at least double by the early 1980's, aided by the trend toward increased European acceptance of automatic transmissions. European acceptance is also forecast of a new 4-stroke cycle diesel engine to be produced in 1979. In a comprehensive and convincing series of tests comparing manual and automatic transmissions staged at the Francorchamps racing circuit, potential economies in fuel, driver effort and time, reduced engine wear and tear, and the effectiveness of integral retarders were demonstrated.

by Ralph Dodd

Publ: Automotive Engineer v3 n4 p32-3, 36 (Aug-Sep 1978)
1978

Availability: See publication

HS-024 114

TRUCK CHASSIS DESIGN

Five papers dealing with various aspects of design and with behavior in service of commercial trucks are reviewed, in order to provide useful data for the chassis designer and commercial vehicle body builder. As introduction to that literature, the history of chassis development and the way chassis are designed for their purpose are discussed. Ladder-type frames have been, and are likely to continue to be, the usual form of truck chassis. Bending strength is built in to the sidemembers, while the crossmembers stabilize against twisting, and support the engine/transmission system. The ladder frame of the medium and heavy truck must weave freely under arduous road conditions, necessitating a torsionally flexible frame. Body

mountings are designed to feed loads into the webs of the channel sidemembers. The overall functions of the frame are to carry the body and payload, to retain alignment of the axles and driveline, and to transmit the steering, driving, and braking forces from the respective axles to the mass of the vehicle. Method of attachment of crossmembers to sidemembers by flange or web joint varies between manufacturers. Generally the lighter higher-volume vehicles employ the flange method, and the heavier low-volume models the web joint. The chassis frame must be sufficiently flexible torsionally to accept the required deflections without overstress, a question of resilience rather than strength. Papers reviewed include discussion of the following topics: fundamentals of chassis frame design (with mention of legal restrictions on length, axle spacing, and axle loadings); sidemember design based on graphical representation of section properties examined by computer; tests establishing the importance of designing in-frame sidemember stability to fully exploit chassis bending strength; detail design of sidemember attachments; and analysis of the need to raise the torsional stiffness of chassis frames.

by John Fenton

Publ: Automotive Engineer v3 n4 p26-9, 31 (Aug-Sep 1978)
1978; 5refs

Availability: See publication

HS-024 115

SKILL-BUILDING BASIC TRANSPORT [BASIC TRANSPORT VEHICLE (BTV) INDUSTRY FOR "THIRD WORLD" COUNTRIES]

The Lola/Specialised Mouldings BTV (basic transport vehicle) design is different from that of most, since it would enable the manufacturer to start with a raw workforce and gradually increase its skills. Initially, this BTV was a joint project involving Lola Cars, Specialised Mouldings, and Chrysler United Kingdom, although Chrysler has since withdrawn. Lola Cars designed the structure and was responsible for the layout of the mechanical components, while Specialised Mouldings was responsible for the design of the GRP (glass-reinforced plastic) panels. Chrysler gave assistance in the styling, the selection of mechanical components, feasibility and costing. The vehicle has been designed for heavy-duty operation where roads are poor or nonexistent and where servicing facilities are rudimentary. It is based on a robust frame and has an orthodox mechanical layout and simple body. It was conceived as a two-door pickup truck, an open truck with canvas hood, or a sedan with an upwards lifting rear door. The design consists of a floor, box-section sidemembers that extend from front to rear, a dash panel, and a couple of crossmembers. Although the door inner panels would be steel, the remainder of the exterior would be GRP. The BTV would have a 1.3 litre low-compression ratio engine and four-speed gearbox. The vehicle could form the basis of an industry in such places as Antigua, Costa Rica, and the Philippines. In the initial stage, prototype vehicles would be supplied from Britain; subassemblies could be provided, including the basic structure, and these could be built with the aid of people sent over for training purposes. For a limited period, it would probably be preferable if sets of steel and GRP panels were supplied, while local manufacture of these panels was being increased progressively. Ultimately, all the panels would be produced in the same factory, where assembly would also take place. The experience gained in the manufacture of sheet metal fabrications and glass fibre

mouldings could be transferred to other areas, providing two other basic industries.

by John Hartley

Publ: Automotive Engineer v3 n4 p12-4 (Aug-Sep 1978)

1978

Availability: See publication

HS-024 116

HIGHWAY FENCES AS VEHICLE-DEER COLLISION DETERRENTS. FINAL REPORT

A survey of highway fencing along Interstate 80 in Centre County, Pa. showed that 7 1/2-ft, type 3-modified fence has little value as a vehicle-deer collision deterrent. Gaps underneath the fence allow many deer to crawl under to the planted right-of-way. From Dec 1974 through Mar 1976, numbers and position of deer were observed from a vehicle driven along six miles of I-80 at night. Bimodal patterns of abundance were found; deer were most numerous in spring and fall, and of 2577 deer sightings, 74.5% were on the highway side, 25.5% on the far side of the fence. Comparisons between a control area (north side of highway) where the fence was unmodified and test areas (south side) where gaps underneath were plugged and/or top five wires were removed or repaired, showed that the critical weakness in the fence is the underside. However, large numbers of deer were also found to cross a fully-repaired fence. Only six deer were reported killed during the 16 months of study, and no live deer were seen on the highway. These results, and others since 1967, strongly suggest that high traffic volume prevents deer from venturing onto the highway. The traffic itself forms a moving fence. It is recommended that 7 1/2-ft, type 3-modified fence be discontinued along four-lane highways through forested areas since it is ineffective in reducing the number of deer feeding on rights-of-way. Where such fences already exist, their effectiveness can be increased by shutting off gaps underneath, even though deer will still cross a fully-repaired fence. In view of the greatly reduced mortality of deer on I-80 in an area where the fence has been shown to be ineffective and where traffic volume has been negatively correlated with deer mortality and with the number of live deer seen on the traffic lanes, it is further recommended that in areas with very high traffic volume, such as I-80, the installation of fences, even completely deer-proof ones, be discontinued. Along interstate highways with less traffic volume, fencing at least 9-ft high should be installed and carefully maintained. An alternate possibility for fence placement would be a location closer to the highway, not at the junction of the forest and planted areas. If allowed to feed on the planted areas the desire to cross the fence is probably lessened. Additional advantages to this placement are that gaps under the fence would be fewer due to the more level ground, and that there would be no problem with falling trees.

by E. D. Bellis; H. B. Graves

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16802

53029

1976; 29p 7refs

Sponsored by Pennsylvania Dept. of Transportation and Federal Hwy. Administration.

Availability: Pennsylvania Dept. of Transportation; Federal Hwy. Administration

HS-024 117

URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOL. 1. EXECUTIVE SUMMARY. FINAL REPORT

A three-phase research project was undertaken to identify the safety and operational problems of pedestrians at intersections, and to develop standardized procedures and traffic control devices (signals, signs, and markings) for reducing these problems. Phase 1 (Vol. 2) dealt with the investigation and identification of operational and safety problems resulting from the interaction of pedestrians and motorists at urban-type intersections. Phase 2 (Vols. 3 and 4) dealt with research in signal timing for the pedestrian, and evaluation of pedestrian signal displays and operation. Phase 3 (Vol. 5) evaluated some alternatives to full signalization at intersections requiring pedestrian protection.

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DOT-FH-11-8533

Rept. No. FHWA-RD-77-142; 1977; 30p

Rept. for Jun 1974-Jun 1977. Vol. 2 is HS-024 118; Vol. 3 is HS-024 177; Vol. 4 is HS-024 119; Vol. 5 is HS-024 120.

Availability: NTIS

HS-024 118

URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOL. 2. IDENTIFICATION OF SAFETY AND OPERATIONAL PROBLEMS AT INTERSECTIONS. FINAL REPORT

In this first phase of a three-phase project studying pedestrian safety at urban intersections, a study was undertaken to identify and define the safety and operational problems associated with the interaction of pedestrians and vehicles at signalized and nonsignalized intersections. Accident data, expert opinion, behavioral observations, and conceptual investigations were used to define problems and uncover implications for countermeasure concepts. Significant findings from all sources are presented in four categories. Undesirable pedestrian and vehicle interactions include turning vehicle conflicts with pedestrians; acceptance of small vehicle gaps by pedestrians; pedestrians crossing when through vehicles are moving through the crosswalk area; short time exposure of pedestrians to drivers; pedestrian required to run in response to a turning or through vehicle; pedestrian required to hesitate while crossing in response to a turning or through vehicle; and pedestrian obscured by a stopped or standing vehicle (not a parked vehicle), before moving into a lane of traffic. Undesirable pedestrian and/or driver behaviors were pedestrian crossing the intersection diagonally, running in or into the roadway, crossing the roadway entirely against the signal, starting to cross during the caution indication on the signal, and anticipating the signal (starting to cross before signal changes in his favor); vehicle backing through crosswalk after being trapped by signal; pedestrian and driver inattention; and failure by pedestrian to use available traffic control devices (pushbuttons, marked crossings, etc.). Undesirable intersection characteristics were inadequate driver and pedestrian sight distances (caused by parked vehicles, street furniture, and vegetation); inadequate roadway lighting; wide roadways without adequate provisions for pedestrian crossing; lack of enforcement of laws/ordinances; complex presentation of numerous signs/signals/markings; environmental and roadway distrac-

tions; inadequate provisions for handicapped pedestrians; and near-side bus stops. Undesirable traffic control device characteristics were nonstandard device(s) application; inadequate signal timing; nonuniform and/or improper signal color/size/message; inconsistent use of messages; failure of device to convey proper message; failure of device to meet pedestrian and/or driver expectancies; and crosswalks conveying a false sense of security to pedestrians. Several countermeasure concepts include increasing driver and pedestrian sight distances; reducing turning vehicle/pedestrian conflicts; improving signal timing; improving visibility (lighting); shielding (focusing) vehicle and pedestrian signals; improving crosswalk applications; providing far-side bus stops; improving pedestrian signal messages/colors/displays; providing additional clarification of required pedestrian and driver actions at intersections; improving enforcement; and improving driver and pedestrian education. Information for designing and evaluating specific countermeasures is presented.

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Rept. No. FHWA-RD-77-143; 1977; 124p 120refs
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is HS-024 120.
Availability: NTIS

HS-024 119

URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOL. 4. PEDESTRIAN SIGNAL DISPLAYS AND OPERATION. FINAL REPORT

In this continuation of the second phase of a three-phase project studying pedestrian safety at urban intersections, three evaluation studies were undertaken concerning the message, color, and operation of pedestrian signals. The first study was a controlled experiment to determine what differences, if any, exist between "lunar" and "clear" white WALK lenses in pedestrian signals. The use of "lunar" white has been criticized for its susceptibility to "sun phantom" or "wash out" when the sun is shining directly into it. It was determined that "clear" has a much better target value under all conditions tested, that "clear" provides better readability when bright sunlight shines directly into lens, that "lunar" is better for all other light conditions with respect to readability (its effectiveness increasing as the level of illumination decreases), and that neither "lunar" nor "clear" is better for all conditions. The second study consisted of three experiments, two of which dealt with the clearance interval display, while the third evaluated flashing vs. steady WALK. Pedestrians have complained of not having sufficient time to complete crossing, and have indicated confusion about the intended meaning of the current flashing DONT WALK display. Two alternative displays were studied, a steady DONT WALK and a steady DONT START. Previous studies have shown that the practice of flashing the WALK indication to warn pedestrians about the possibility of vehicles turning through the crosswalk during WALK interval is not particularly effective. It was concluded that a steady DONT WALK clearance display is as effective as a flashing DONT WALK; that there is little or no improvement with DONT START message over current DONT WALK message; that flashing WALK is not an effective means of warning pedestrians about turning vehicles; that pedestrians need to be made more aware of turning vehicles; that some variance exists in

pedestrians' observance of pedestrian signals from intersection to intersection, and great variance from city to city; and that further research is needed to determine optimal clearance indication and the best means of alerting drivers/pedestrians to turning-vehicle conflicts. The third study evaluated the concept of using symbolic pedestrian displays in place of the current word message display. Five preference surveys were conducted to determine which symbols and colors had the most intuitive meaning, and whether these symbols/colors would be safe to field test. Three symbol displays and two color sets were field tested, resulting in the conclusions that there is a significant improvement with the Hand/Walking Man symbol display over standard WALK/DONT WALK; Standing Man/Walking Man is as effective as WALK/DONT WALK; Circle Slash/Walking Man is not as effective as WALK/DONT WALK; pedestrians prefer red and green signals but achieve significantly higher compliance with orange and white and there is need for an educational program for elementary-school-age pedestrians if symbolic signals come into use.

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Rept. No. FHWA-RD-77-145; 1977; 173p 12refs
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is HS-024 120.
Availability: NTIS

HS-024 120

URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOL. 5. EVALUATION OF ALTERNATIVES TO FULL SIGNALIZATION AT PEDESTRIAN CROSSINGS. FINAL REPORT

In this final phase of a three-phase project studying pedestrian safety at urban intersections, a study was undertaken to identify and evaluate alternatives to full signalization at school and other pedestrian crossings. The site studied is characterized as follows: intersection of an arterial street (often high speed) with a low-volume residential street; inadequate gaps in the traffic to allow a pedestrian to cross arterial street safely without an unreasonable time delay; pedestrians usually school children, the elderly, and the handicapped; and installation of full signalization not warranted by pedestrian and minor-street vehicle volumes, and accident experience. The selection of alternatives for study did not include grade-separated pedestrian structures or mid-block crossings. Five school-pedestrian crossing designs were selected for evaluation: sign and stop sign (sign and beacon on major street approach, stop sign on local residential street), flashing yellow signal and flashing red beacon (standard traffic signal dwelling in flashing yellow on major street, flashing red beacon on local street), flashing green signal and stop sign (standard traffic signal dwelling in flashing green on major street, stop sign on local street), (Sg-44) signal and stop sign (standard traffic signal dwelling in solid green on major street, stop sign on local street), and crossing guard (crossing guard on major street, stop sign on local street). The five designs were evaluated in a time series, matched experimental-control site experimental design. Six measures of effectiveness were evaluated: compliance, behavior, and volume, for both pedestrians and vehicles; vehicle delay; gaps in the major street vehicular traffic stream; and driver understanding. A detailed comparison was made between each school-pedestrian crossing design and its fully-signalized control site, and a comparison was made among the

crossing designs. The advantages of the five designs over signalization were determined: increased pedestrian compliance to the pedestrian signal, reduction in the stop time per vehicle on the major street approach, and reduction in installation costs. Disadvantages included reduction in both pedestrian and drivers' understanding of traffic control device operation and a negligible increase in vehicle angle conflicts. The crossing guard, (Sg-44) signal and stop sign, and flashing green signal and stop sign were judged to have more desirable operating characteristics than those measured at the fully-signalized control site. Guidelines for the selection of the alternatives and the appropriate site criteria are included.

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YT-FH-11-8533
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pt. for Jun 1974-Jun 1977. Vol. 1, Executive Summary, is
S-024 117; Vol. 2 is HS-024 118; Vol. 3 is HS-024 177; Vol. 4
HS-024 119.
Availability: NTIS

S-024 121

THE MOTOR VEHICLE--A GOOD TARGET FOR LEGISLATION

A review is presented of some factors influencing the development of motor vehicle legislation in the U.K. during the last 25 years, and the effect of this legislation on the work of automotive engineers employed by the government. The following topics are discussed: background history; development of national regulations (powers and scope); growth in the vehicle population and accident casualties; change in national regulations (lights, reflectors, and directional signals, brake performance and vehicle testing, other vehicle safety items, environmental items--noise and air pollution); transition from national to international regulations; influence of the U.S. and Europe (crash protection, control of pollutants from gasoline engines, the move towards "type approval"); national type approval; inspection of vehicles in service (the MOT (Ministry of Transport) test, the HGV (heavy goods vehicle) test); winter road maintenance; and investigation of accidents and defects. Tables provide the following information: a list of ECE (Economic Commission for Europe) regulations, EEC (European Economic Community) directives, C (Construction) and U (Use) regulations (U.K.), and FMVSS (Federal Motor Vehicle Safety Standards, U.S.); summary of MOT test results for 1976; results of goods vehicles spot checks for 1964-1976; and results of inspections at HGV testing stations for 1970-1977. Graphs provide statistics on motor vehicles in use 1904-1976 and forecasts up to 1995, accidents and casualties 1934-1975, and limits on air pollutants from vehicles (carbon monoxide, hydrocarbon, and nitrogen oxides) introduced in the U.K. in 1973 and 1976 and proposed for 1980 and 1981.

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92 p157-70 (Jun 1978)
78; 18refs
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Availability: See publication

HS-024 122

WHAT'S THE STATUS OF AIR BAGS?

The pros and cons of air bags as passive restraint systems in American automobiles are reviewed. Most insurance companies favor air bags, the strongest lobbyist being Allstate. The insurance industry estimates the result of 100% installation of air bags or other equally effective passive restraint systems will be an average annual saving of at least \$32 per insured car. Besides far fewer medical costs and law suits, the insurance savings would almost pay for the cost of the air bag itself within three years. One of the most active organizations in air bag research is Calspan Corp. Calspan's investigation of 72 accidents involving cars equipped with air bags has not produced a single fatality or serious injury. A recent Gallup Poll indicated that most young adults (18-29 years of age) support air bag use, while 31% of those 50 years and older favor air bags and 44% disapprove of them. Opponents of air bags argue that the systems are unproven, that they constitute needless Federal meddling (passive restraints mandatory in full-size 1982 cars, intermediate and compact cars by 1983, and all subcompacts and mini-size cars by 1984), and that they will raise consumer costs and increase gas consumption. While lauding the concept of air bags, the American Automobile Assoc. (AAA) has been a vocal opponent of their mandatory installation because of costs exceeding benefits, too little real-world experience, questionable effectiveness, and unproven reliability. Auto manufacturers are against air bags because of the costs involved. Despite its opposition, General Motors (GM) is willing to offer air bags and automatic seat belt systems as an option. An automatic belt system will be offered as an option on three representative car lines, possibly by the start of the 1979 model year, and air cushion restraints on all full-size cars by the start of the 1981 model year. This is GM's second program offering passive restraint systems as options; air cushion systems were offered on full-size and luxury models during 1974 through 1976 model years (total sales of about 10,000). If Ford's engineering plans are successful, a passive belt will be offered as an option on at least one mid-size car line in 1980, and air bags will be an option on at least one of the full-size car lines, and passive belts on a subcompact vehicle in model year 1981. Chrysler is against air bags, believing in mandatory seat belt use. Some misleading publicity concerning air bags has been provided by Ralph Nader's air bag lobby and some insurance companies, who are dealing with emotion and ignoring the facts. In early 1977, the National Hwy. Traffic Safety Administration allegedly suppressed results of tests (conducted by Calspan) highly unfavorable to air bags. In the continuing air bag debate, it is suggested that motorists be permitted to select the system they want (air bags, passive diagonal shoulder harnesses, or another available system), as optional equipment.

by Ed Janicki
Publ: Automotive Engineer v3 n4 p62-3, 70 (Aug-Sep 1978)
1978
Availability: See publication

HS-024 123

PROVIDING AN ALTERNATIVE TO GASOLINE

A popular account of the use of alcohol (methanol and ethanol) as a substitute or supplemental fuel for gasoline is presented. Alcohol works in an automobile engine, and today's engines can operate on a 15% alcohol-85% gasoline mixture without suffering in performance and without any major

modifications to the engine. Using more than 15% alcohol would require engine changes well within today's technology. When grain prices fell several years ago, farmers urged the Federal government to invest in research on converting surplus grain into ethanol for use in gasoline. Methanol can be made not only from coal, but also from waste products, wood chips, corn stalks, and even garbage. More alcohol per mile is needed in automobiles compared to gasoline (80 cents to \$1 worth of methanol and about \$1.80 worth of ethanol to replace 40 cents (wholesale) of gasoline), and there would be the need for a larger fuel tank if 100% alcohol fuel were used. One detriment to the use of alcohol as fuel for motor vehicles is the possibility of manufacturing gasoline from coal at a less prohibitive cost.

by Jerry Flint
 Publ: Autoweek v28 n38 p5 (22 Sep 1978)
 1978
 Availability: See publication

HS-024 124

IMPACT ON TRAFFIC SAFETY OF THE INTRODUCTION OF SUNDAY ALCOHOL SALES IN PERTH, WESTERN AUSTRALIA

An analysis of the number of persons killed and the number of casualty accidents in the three years before and after the introduction of Sunday sales of alcoholic beverages in Perth, Western Australia (law effective 7 Jul 1970), indicates that the new law had a detrimental effect on traffic safety. The Sunday fatality and casualty accident rates were compared with the rates of the other six days of the week during the periods before and after the new law. Separate comparisons were made for the Perth area and the rest of the state. In the Perth area, in the three years before the new law, 11% of the 453 accident fatalities occurred on a Sunday; after the new law, 16.9% of 486 accident victims were killed on a Sunday. In the rest of the state the proportions were 18% and 17.4% before and after, respectively. The proportion of casualty accidents occurring on a Sunday in the Perth area increased from 12.4% of 11,598 before the new law to 14.2% of 11,870 after the law. In the rest of the state, the proportion of casualty accidents occurring on Sunday decreased from 19.7% to 18.4%.

by D. Ian Smith
 Publ: Journal of Studies on Alcohol v39 n7 p1302-4 (Jul 1978)
 1978; 2refs
 Availability: See publication

HS-024 125

UNWARRANTED DELAYS BY THE DEPARTMENT OF TRANSPORTATION TO IMPROVE LIGHT TRUCK SAFETY. REPORT TO THE CONGRESS OF THE UNITED STATES BY THE COMPTROLLER GENERAL

Because of the growing popularity of pickup trucks and vans, a review was made of the feasibility of extending the existing Federal Motor Vehicle Safety Standards (FMVSS) to cover these vehicles, either directly or in a modified form. Since sales of these light-duty vehicles have increased in recent years and are projected to continue in the future, the increased number of occupants killed in these vehicles is causing concern. Light trucks are exempt from many major motor vehicle safety standards required for passenger cars, including

those for interior padding, head restraints, impact-absorbing steering columns, braking distances, side door strength, and roof crush resistance. Some other safety standards, such as restraint systems and windshield mountings, have been applied to these light-duty vehicles but in some cases are less stringent than those set for passenger cars. Because occupants of light trucks have fared worse in crashes than occupants of passenger cars, it is necessary that the National Hwy. Traffic Safety Administration initiate expeditious research and rulemaking to improve the safety of light trucks, and take steps to provide prospective buyers with information on the relative safety of the wide variety of vehicles offered for sale.

General Accounting Office, Washington, D.C. 20548
 Rept. No. CED-78-119; 1978; 87p
 Availability: General Accounting Office, Distributing Section, Room 1518, 441 G St., N.W., Washington, D.C. 20548

HS-024 126

THE U.S. AUTOMOBILE INSURANCE MORASS AND THE BRITISH EXPERIENCE

In late 1976 surveys, 11% of U.S. consumers rated the performance of their automobile insurance company as "good" and 18% rated this performance as "poor", compared to U.K. figures of 18% and 4%, respectively. The striking contrast between the two results cannot be explained by the hypothesis that the British take a more positive view of all their institutions. British and American respondents assessed almost equally the performance of their banks and life insurance companies. One clue to the greater dissatisfaction among U.S. automobile insurance consumers might be the sharp increase in premiums after 1974, which outstripped the overall cost of living increase during 1976 (compared to the U.K. where both the premiums and cost of living rose in 1975 and 1976). Other factors possibly contributing to the differences in public attitudes between the U.K. and U.S. include different risk classification and rating systems, different underwriting practices and handling of "difficult" risks, and a more visible industry-wide effort in Britain to reduce claim costs. Under the British "no-claims" discount system, the British motorist may qualify after the first year for a discount which increases for each successive year during which no claims are reported, up to 60% after four years. Differing from the surcharges applied under the U.S. "safe driver" plans, the formula used to calculate this discount is well-known, and enables every policyholder to determine the advisability of reporting a claim or bearing the repair costs. The problem of insuring the unwanted risk in the U.S. is illustrated by the increased number of assigned risk pools (generally meaning higher premiums and poorer service) in recent years. In the U.K. there appears to be less fine tuning of underwriting standards than in the U.S.; even standard risks generally can obtain coverage at a price. British experience indicates that united efforts by U.S. insurers to reduce and control the costs of auto repairs, tort liability actions, and medical care would substantially enhance the insurers' public image.

by Philip H. Dutter
 Publ: Best's Review. Property/Casualty Insurance Edition v79 n5 p14, 16, 108, 112, 114 (Sep 1978)
 1978
 Availability: See publication

HS-024 127

AUTOMOBILE INSURANCE--1977

As automobile insurance underwriting again became profitable in 1977, insurance companies found that their standing with the public deteriorated at almost an inverse ratio. In order to overcome the huge dollar losses of the preceding three years, the companies had had to raise rates. The issue of availability of coverage is causing the Federal Trade Commission to investigate redlining. Medical costs and repair costs continue to escalate, and the trend to smaller cars creates greater risk of injury in an accident, and higher repair costs. In 1977 the automobile industry recalled more passenger cars than it sold, and manufacturers and dealers are in need of high product liability coverage. The auto insurers must confront the question of how a contract designed to protect the individual insured can meet the new concept that the policy should act as reparations for a third party. An effort has been made to deal with this through no-fault insurance, but this has not been satisfactory, largely because of too many political concessions at the state level, and an inability to reach agreement on the advantage of national standards. Statistics on U.S. automobile insurance are tabulated and discussed. Figures show that premiums received by insurance companies for automobile coverages in the U.S. in 1977 totaled \$30.4 billion, a 20% increase over 1976. The 20% gain in 1977 compares with 23% the year before, and the rate of increase so far in 1978 is such that the overall percentage gain can be expected to drop again. Private passenger liability premium volume (49.1% of the total auto business) gained 17% to reach \$14.9 billion; the pure loss ratio fell five points to 63.4%. Commercial auto liability (12.9% of the total) was ahead 25%, reaching \$3.9 billion, and it also had a five-point drop in loss ratio to 57.9%. Private passenger physical damage premiums (31.6% of the total) were \$9.6 billion, a gain of 21%, and the loss ratio was down 10.8 points to 61.6%. Commercial physical damage (6.4% of the total) showed a 24% gain in premiums to \$1.9 billion, and the loss ratio of 53.2% was 7.6 points under 1976. During this year of favorable underwriting, the emphasis on sales remained with the direct writers, and in 1977 these companies passed the 50% mark in total market share. The regional/specialty companies also increased their overall participation, while the national agency companies lost more than a full point for the second year in a row. More than half of the auto insurance business in the U.S. is written by 15 companies, led by State Farm. Private passenger auto makes up a little more than one-third of the total insurance premium volume in the U.S. Eight states account for a little over half of all U.S. auto insurance business, the top three being California, New York and Texas.

Publ: Best's Review. Property/Casualty Insurance Edition v79 n5 p10-11, 114, 116, 118 (Sep 1978)
1978

Availability: See publication

HS-024 128

SYNTHETIC OILS. SLIDING INTO THE FUTURE WITH ERSATZ LUBRICANTS

A discussion is presented of a new class of fuel-efficient engine oils which are partly synthetic lubricant. Synthetic lube stocks are made by chemically combining, or "synthesizing," low-molecular-weight compounds into those with higher molecular weight. Feedstocks are still largely petrochemical, but coal tars can yield some of the necessary components and in theory, animal and vegetable feedstocks might help. Even if

derived from petroleum, synthetic stocks are seen as a means of stretching resources because of properties brought about by their selective formulation. From a technical point of view, these partial synthetics are seen as a logical step in lubricant evolution. Modern engine oils are multifunctional to an extreme. They lubricate, transfer heat, seal the piston/cylinder interface, minimize the formation of crud and disperse that which is formed. These oils operate at temperatures ranging from wintery ambient to several hundred degrees F, in an atmosphere that is usually oxidative, with contaminants to combat. The new partial synthetics, which are expected to perform even better than modern engine oils, are discussed in terms of synthesis vs. conventional refinement, temperatures and viscosity, rating, and fuel efficiency. Tables provide a comparison of typical synthetic and conventional oil specifications, and relative performance of the conventional and synthetic oils. Manufacturers' performance claims for the new oils compared to conventional ones are included.

by Dennis Simanaitis

Publ: Road and Track v30 n2 p38-42, 46-7 (Oct 1978)
1978

Availability: See publication

HS-024 129

IN-USE MOTORCYCLE SOUND LEVELS

To help develop the substantial data base necessary for formulating objective surface transportation noise control policies, an investigation crew conducted two days of motor vehicle sound level monitoring, on a Sunday at an urban-fringe highway, and on a Monday, at an urban surface street site. A factor in policy determination ought to be the relative contributions of each vehicle type to overall surface transportation noise. Results of the monitoring show that stock motorcycles (determined to be operating with standard factory-equipped exhaust systems) are generally quieter than modified motorcycles (determined to be operating with owner-initiated exhaust system modifications). The sound level mean for stock motorcycles was 5.3 dBA less than that for modified motorcycles. Automobiles and stock motorcycles were found to have comparable sound levels. The sound level range of the stock motorcycles was found to lie within the sound level range of the main body (98.7%) of automobiles; in fact, the stock vehicle sound levels were less than or equal to 2 out of 5 of the automobile sound levels. Generally speaking, trucks, vans, and pickups were louder than stock motorcycles, the sound levels of 81% of these vehicles being higher than those of stock motorcycles. It was determined that motorcycles contribute insignificantly to the total traffic noise energy. The distribution of motor vehicle sound energy per hour was 54.8% for automobiles; 36.4% for trucks, vans, and pickups; and less than 1% each for stock and modified motorcycles. Garbage trucks are grossly disproportionate sound energy contributors as compared to their traffic mix representations, having a sound energy-to-traffic mix ratio of 34.0 to 1.0. Buses and trucks, vans, and pickups had considerably lower ratios of 4.0 to 1.0 and 3.5 to 1.0, respectively. Modified motorcycles, stock motorcycles, and cars had the lowest ratios with 2.0 to 1.0, 1.3 to 1.0, and 0.6 to 1.0, respectively. In order to eliminate loud motorcycles from the road, enforcement of in-use noise standards should be intensified, and new product standards for new replacement

exhaust systems and components should be adopted and enforced.

by Wayne Elliott Marcus

Motorcycle Industry Council, Newport Beach, Calif.

Rept. No. SAE-780707; 1978; 12p 2refs

Presented at West Coast Meeting, San Diego, 7-10 Aug 1978.

Technical Paper Series.

Availability: SAE

HS-024 130

STUDY AND PROGRAM PLAN FOR IMPROVED HEAVY DUTY GAS TURBINE ENGINE CERAMIC COMPONENT DEVELOPMENT. FINAL REPORT

A study was conducted to establish a viable program to improve specific fuel consumption (sfc), by use of ceramic materials in the Detroit Diesel Allison Model 404 industrial gas-turbine engine. These ceramic materials permit increases in cycle operating temperatures and contribute to improved component efficiencies. The overall program objectives, using ceramic materials were to improve the sfc from 274 mg/W-hr (0.45 lb/bhp-hr) to 213 mg/W-hr (0.35 lb/bhp-hr) in a five-year program (by 1981); to demonstrate a commercially-viable engine, and conform with current and projected Federal noise and emission standards. The study established that the fuel consumption objective could be met by the use of ceramics in the regenerator disks and seals, turbine inlet vanes and stationary turbine tip shrouds, turbine inlet plenum, gasifier rotor blades, combustor, and exhaust diffusers along with component efficiency improvements in the compressor, turbines (gasifier and power), and regenerator disks. At a turbine inlet temperature of 1204 degrees C (2200 degrees F), the fuel consumption is within 2% of the goal, and at 1371 degrees C (2500 degrees F), the goal was exceeded. At the 213 mg/W-hr sfc level, fuel savings achieved were 116,000 liters (30,600 gal) per truck or 100,000 liters (26,500 gal) per bus in a typical 805,000-km (500,000-mi) engine life. In addition, it was shown that the engine-related life-cycle costs of a typical highway truck or an intercity bus are improved by 5% to 15% (depending on the ceramic materials and fuel costs that are assumed). Noise and emission regulations can be met by the improved engines with minimal development. The development risks associated with ceramic materials vary with the components, the regenerator being the lowest risk and the turbine rotor blade the highest risk in the time chosen for the program. Components selected for development are considered to be feasible for demonstration in the program planned. An engine development plan which addresses the overall program objectives was prepared using the results of the study. The steps involved in the program are to increase the turbine inlet temperatures successively from 1002 degrees C (1835 degrees F), the baseline figure, to 1038 degrees C (1900 degrees F) to 1132 degrees C (2070 degrees F) to 1241 degrees C (2265 degrees F) with stepwise increases in the numbers of ceramic components, and to the aerodynamic component efficiencies.

by H. E. Helms

General Motors Corp., Detroit Diesel Allison Div., P. O. Box 894, Indianapolis, Ind. 46206

NAS-3-20064

Rept. No. CONS/0064-1; NASA-CR-135230; DDA-EDR-9068; 1977; 157p 7refs

Project management by National Aeronautics and Space Administration, Lewis Res. Center, Cleveland, Ohio 44135 (Interagency Agreement EC-77-A-31-1011).

Availability: NTIS

HS-024 131

LOAD LEVELING SYSTEM FOR MOTORCYCLES

The Leveler, by Number 1 Products, Inc., is a different approach toward solving the variable-load problem of motorcycles. While this system is undoubtedly the most mechanically complex of any of the adjustable systems, it is perhaps the easiest to operate (adjustments can be made while underway) and is truly fail-safe. A broken line or other lost-pressure failure does not allow the suspension to collapse. Rather, the suspension reverts to non-Leveler, conventional operation. Instead of using air as the spring medium, the Leveler retains the conventional coil spring. To compensate for varying weight conditions, a hydraulic cylinder loads the coil spring in much the same manner as a can-type preload adjuster. Because of the additional stroke of the Leveler's cylinder, this system can affect changes in the coil spring's dynamics impossible with preload adjustment alone. The Leveler system has two main parts, the piston/cylinder, which goes atop a no. 1 GP-series shock, and the pump. The reservoir's transparent wall has graduated markings, showing the amount of fluid pumped into the shock cylinders. When the rider is familiar with the system's operation, he can adjust the system for known loads according to the reservoir level. Installing the system is quite simple. In addition to its weight-compensating ability, the Leveler can also be used to tune the rear suspension for varying road conditions. The operator must, however, keep in mind the extra weight on the rear tires when planning a long trip, and the fact that the motorcycle will handle differently with the system (total weight up, weight distribution changed).

Publ: Cycle World v17 n10 p75-6, 85-6 (Oct 1978) 1978

Availability: See publication

HS-024 132

AUTO THEFT. OFFENDER AND OFFENSE CHARACTERISTICS

Findings from three data sources, buttressed by interviews with police, compromise two sociological assumptions about auto theft; first, that it is a favored-group delinquency, and second, that offenders are either joyriders out for a good time or professionals out for a profit. The first data source involved the auto theft investigation unit and the juvenile bureau of the Toledo, Ohio, police force. Between 1 Oct 1975 and 31 May 1976, officers in these units filled out a special form each time an individual (103 cases) was apprehended for stealing a motor vehicle. The form contained questions concerning demographic information about the subject, previous arrest record, description of the auto, and circumstances surrounding the offense, including apparent reason for taking the car(s). The second source of data was the file of stolen automobile reports located in the auto theft investigation unit of the Toledo Police Dept. By a systematic random sampling process, 231 cases of recovered autos were selected from the period of 1 Jan 1975 to 30 Apr 1976. This second source provided a more comprehensive perspective on the nature of auto theft since it represented cases of all cars reported stolen and recovered, regardless of whether an arrest was made. Address from which car was stolen, address of recovery point, type of car, and condition of recovered car were obtained. The third source were data collected for an earlier study by Charles W. Thomas involving a sample of 14,815 juveniles who had come before juvenile court in Virginia between 1 Jan 1966 and 31 Jul 1973. This source was used because it allowed a comparison of auto

118-024 133

thieves' demographic characteristics with those of juveniles apprehended for offenses other than auto theft. It was found that while a portion of auto thieves are white juveniles from better neighborhoods and socioeconomic backgrounds, they do not account for a disproportionate number of juvenile car thieves, as the Wattenberg-Balistrieri findings indicate (most influential and frequently cited research). Furthermore, there is evidence that the proportion of white, middle-class juveniles among those who steal cars is no greater than the proportion involved in delinquencies other than auto theft. Findings also indicate that joyriding and stealing for profit are only two of the reasons for stealing cars. Other reasons include short-term transportation, long-term transportation, and commission of another crime. These types vary according to age of offenders, degree of sophistication in stealing cars, extent of damage inflicted, and model year of cars stolen.

by Charles H. McCaghy; Peggy C. Giordano; Trudy Knicely Henson
Publ: Criminology v15 n3 p367-85 (Nov 1977)
1977; 28refs
Revision of a paper presented at Annual Meeting of American Society of Criminology, Tucson, 4-7 Nov 1976.
Availability: See publication

HS-024 133

IN DEPTH STUDY OF SERIOUSLY INJURED SEAT BELT WEARERS

Case studies are presented for 142 occupants wearing seat belts who sustained injuries and were hospitalized, and for the 127 vehicles in which they were occupants, as a result of 122 collisions which took place between 27 Jun 1974 and 8 Jul 1975 in the vicinity of Sydney, New South Wales. This study, called IMPACT 2, was directed at crashes of severity between the minor crashes which cause relatively little injury and the very severe crashes which dominated an earlier study (IMPACT 1) whose aim was to determine why car occupants were killed in spite of wearing seat belts. In the present study, the main hazards were found to be narrow, unyielding parts of car interiors which could be struck by the head, chest, pelvis, or limbs of a seat belt wearer. As in the IMPACT 1 project, the need was seen for stiff, deep padding, more space, less easily deformed occupant compartments, and possibly more yielding window glass. Many of the manually-adjusted seat belts appeared to have been adjusted very loosely. It is suspected that the automatically-adjusting belts required for new cars since 1975 have substantially reduced the incidence of some injuries. A number of seat belts in cars manufactured between 1969 and 1974 released their occupants at forces below those which seriously injure some people. Further field study is desirable to check whether new tests of seat belt strength have led to a satisfactory balance between belt breakage and occupant injury. Unrestrained rear-seat occupants and broken seats contributed loadings to the backs of occupants, adding to injury in many cases, and contributing to several seat belt releases. There is a need for stronger seats and more consistent wearing of seat belts by rear-seat occupants. Further investigation is needed into the problem of seat belt location on the pelvis. Finally, hoods of some cars appear

unnecessarily prone to entry through the windshield in severe off-center frontal crashes.

by B. W. Holt; B. A. Vazey
New South Wales Dept. of Motor Transport, Traffic Accident Res. Unit, Sydney, N.S.W., Australia
Rept. No. NSWDMT-TARU-1/77; 1977; 133p 16refs
Project Rept. on IMPACT-2. Sponsored in part by Australian Dept. of Transport.
Availability: Director, Road Safety Information Service, G.P.O. Box 1839Q, Melbourne, Vic. 3001, Australia

HS-024 134

LEARN THE BIG 5 OF MOPED SAFETY AND PLEASURE

Information on safe moped operation is outlined in this booklet in terms of five factors. It is suggested that the details presented for each of the following "Big 5" of moped safety be committed to memory: the moped, its capabilities and limitations, including a pre-ride safety checklist; the road, its personality and the ways it can change; the operator, the person who has the power to make safety work; the other person, the ones with whom the road is shared; and the weather, the fickle friend or foe of all riders. Optional equipment for the moped and rider, and the goals of the Moped Assoc. of America are also described.

Moped Assoc. of America, 1001 Connecticut Ave., N.W., Washington, D.C. 20036
1978; 16p
Availability: Corporate author \$.25

HS-024 135

EVOLUTION OF THE TRAILER AIR BRAKE SYSTEM UNDER THE EFFECT OF FMVSS 121 [FEDERAL MOTOR VEHICLE SAFETY STANDARD]

Prior to the introduction of Federal Motor Vehicle Safety Standard (FMVSS) 121, Air Brake Systems, on 1 Jan 1975, there were minimal requirements for braking performance of trailers equipped with air brakes and they could be met by any reasonable selection of components. All components were functionally interchangeable; all manufacturers' parts could be interchanged. When FMVSS 121 became effective for trailers, there were seven unique systems available; in general, individual components from one brake system manufacturer cannot be installed in another system. In the little over two years since FMVSS 121 has been in effect, there have been many changes in the regulation. The main tenets behind the regulation, stability, steerability, and stopping distance, have not changed. Technology met the challenge of FMVSS 121 and provided sophisticated electronics packages on trucks and trailers. The braking systems have undergone rapid change. Tandem axle trailers have gone from three air reservoirs to the possibility of one. Vehicles have gone to two-wheel speed sensors and maintained the stability, steerability, and stopping distance of the regulations. The braking systems in the near future will be reduced, on trailers, to the one reservoir, one valve system that resembles the system well-accepted for many years. If government regulations do not change drastically from today's requirements, systems will tend to stabilize and become reasonably simple. The system simplifications that have been made in the near past have been dramatic, but evolutionary in nature. Future evolutionary changes will place

greater emphasis on combining functions, integrating parts into the vehicle, and improving electrical systems.

by Robert Crail; Ben Klimek
Berg Mfg. Co.
Rept. No. SAE-770661; 1977; 12p 4refs
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

HS-024 136

SOLVING THE CASING SHORTAGE WOULD BOOST RETREADING [PASSENGER CAR TIRES]

Although millions of worn passenger car tires are available each year (in 1978, between 150 and 190 million), only about 17% of these casings ever see extended life as retreads. The percentage is even lower for steel belted radials. The lack of a reliable casing collection method perpetuates the shortage, but the main reason for low casing yield is poor consumer tire maintenance. Millions of otherwise retreadable casings are ruined by operating them underinflated, improperly balanced, or with front ends misaligned. Additionally, the radial tire's tendency toward shoulder wear results in disqualification of a high number of casings. With the right equipment, materials and care, radial ply tires can be repaired as well or better than other tires. As consumer tire care education continues, dealers and retreaders can institute some changes in their shops that would have a considerable effect on the casing yield. Consumers must be convinced of the danger of driving on smooth tires. Cash rebates could be offered on trade-ins to encourage the surrendering of a retreadable radial tire. By using state-of-the-art puncture repair techniques, along with in-service bead repairs, dealers will save a lot of tires from the scrap pile. Manufacturers are assisting retreaders by continually improving materials and constructions to make tires more suitable for retreading.

by Robert Snyder
Publ: Tire Review v78 n9 p30, 32 (Sep 1978)
1978
At head of title: Consumer neglect, improper repairs, bead damage.
Availability: See publication

HS-024 137

FATIGUE: A PROBLEM ON THE ROAD...AND OFF. HAS THE TRUCK AND BUS INDUSTRY PROPERLY ANALYSED THE FACTORS OF FATIGUE?

Fatigue elements of the professional truck and bus drivers are outlined and include proper rest, medications, drinking/hangover, distractions, elimination, worry/personal problems, diet, monotony/road hypnosis, adjustment to living routine, and general physical condition. A driver's off-duty lifestyle can be as important as driving performance, when combating fatigue. The Dept. of Transportation's (DOT) suggestion of altering the hours of service is not likely to improve the fatigue factor; to realign the work cycle would simply allow more time and afford more opportunity for drivers to do things that would detract from securing proper rest. The following solutions to the professional driver fatigue problem are suggested: teach drivers to recognize that fatigue is dangerous (it is the number one killer of over-the-road drivers) and show them how to identify fatigue and the ways it affects their ability

to function mentally; stress the health factor (self-discipline); make a greater attempt to instill in all drivers the absolute necessity of stopping at the first sign of drowsiness or fatigue, taking a nap or getting out of the vehicle, and refreshing themselves (stop at least every 75 miles); and provide appropriate, off-duty facilities with better forms of entertainment (e.g. reading rooms, TV, games and other equipment) to help drivers relax when sleep is not needed.

by Henry Lewis
Publ: Steering Wheel p10-1 (Sep 1978)
1978
Availability: See publication

HS-024 138

A BLUEPRINT OF FUTURE TRUCK DESIGNS

Probably the greatest single factor influencing the future design of commercial trucks will be aerodynamics. Trucks will be designed to combat wind resistance in order to improve fuel efficiency, and manufacturers are experimenting with a variety of air shields (e.g. sleepers on top of the cab, split-level cabs, bullet-nosed and accordion-type trailer bodies). Because of the human element involved, driver conditions will be given a lot of attention, and, unless the industry makes improvements on its own, some very strict and expensive regulations can be expected in the areas of ingress/egress, seating, visibility, instrumentation, climate control, interior noise, and comfort. Many different kinds of engines are presently being studied. Gasoline engines will be around for a long time, but there will be many changes in them to enhance fuel economy and life. For diesel and gasoline engines alike, fuel injection systems will be given great consideration. Turbocharging will be almost universally used on all engines because of better emissions and fuel economy. The Wankel engine is favored for its simplicity of parts, the stratified-charge engine for its lean mixture approach. Gas turbines have been popular for the last decade but they have a 20% fuel economy penalty vs. today's engines. Diesels will be the powerplant for the next one or two decades. An electronically-controlled transmission that is almost automatic will be a big innovation. Chassis weight will be reduced drastically with the use of more aluminum, graphite, and fiberglass. Radial³ tires will replace bias tires; the old cross-rib or lug design will disappear because of noise regulations. A one-tread design for all tire positions will appear (perhaps a whole new type of tread design). The new halogen lighting will most probably be used on future trucks. The need for increased goods transportation may force changes in Federal size and weight laws, bringing increases in single-axle restrictions from 20,000 to 26,000 lbs, in tandem axles from 34,000 to 44,000 lbs, GCW axles from 80,000 to 120,000 lbs, and increases in width and length. Doubles and triples may be allowed in all states.

by J. C. Paterson
Publ: Steering Wheel p14-5, 25 (Sep 1978)
1978
Summary of a speech presented at joint Texas Safety and Maintenance Councils meeting, TMTA Convention, Jun 1978.
Availability: See publication

HIGHWAY CAPACITY, TRAFFIC FLOW, AND TRAFFIC CONTROL DEVICES

Twenty-seven studies are presented on measuring delay at intersections, traffic flow characteristics and congestion patterns, demand for fringe parking, parking management, traffic simulations including bus lanes, intersection design, freeway traffic control, traffic control devices, types of left-turn channelization and experience with right-turn-on-red, driver behavior at signalized intersections, Virginia's crash program to reduce wrong-way driving, effects of flashing beacons at intersections, effects of signal phasing and length of left-turn bay on capacity, settings for pedestrian-actuated signal control systems, level of service at signalized intersections and estimation of unprotected left-turn capacity at signalized intersections, efficacy of dotted extended lines at exit lanes, location effectiveness of freeway signs, traffic control in an urban highway network, in congested areas and on a diamond interchange.

by Anne Ricker, ed.
National Acad. of Sciences, Transportation Res. Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418
Rept. No. TRR-644; 1977; 144p 235refs
Includes HS-024 140--HS-024 166.
Availability: TRB \$7.80

HS-024 140

TECHNIQUE FOR MEASURING DELAY AT INTERSECTIONS

Findings are presented on a design for a simple, accurate technique for measuring vehicular delay on the approach to a signalized intersection. Precise definitions were established for four measures of performance: stopped delay, time-in-queue delay, approach delay, and percentage of vehicles stopping. Approach delay was selected as being most representative of intersection efficiency. Four manual methods using film taken at 10 intersections were tested in the laboratory. The values thus obtained were statistically compared with true values from time-lapse photography. The point sample, stopped delay procedure and the percentage of vehicles stopping method were selected as the most promising methods for practical use and were performed in the field at three sites. Correction factors were developed to allow the field results to estimate more accurately the true values of stopped delay and percentage of vehicles stopping. Interrelationships among the four measures of performance were established so that approach delay could be estimated from a value for stopped time. Intersection delay studies should not in most cases be performed on an individual lane basis; rather, an entire approach should be studied at one time.

by William R. Reilly; Craig C. Gardner
JHK and Associates, Tucson, Ariz.; Tucson Dept. of Traffic Engineering, Ariz.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C. 1977 p1-7
1977; 9refs
Availability: In HS-024 139

HS-024 141

CONSISTENCY OF MAXIMUM FLOW CHARACTERISTICS AND CONGESTION PATTERNS ON AN URBAN FREEWAY DURING MORNING PEAK PERIODS

Based on criteria for selecting maximum flow characteristics, data for 420 cells were collected on the Santa Monica Freeway for the period 1972-1975. Each cell includes three observed values: maximum flow rate, corresponding percentage of occupancy, and corresponding time. For the analysis of morning congestion patterns, 6 d of data (5:00 to 11:00 A.M.) were collected. These data were selected for a randomized-block design with three independent variables: years, workdays, and locations. Analysis-of-variance and multiple-pairwise-contrast procedures showed that the most crucial independent variable causing inconsistency is locations, the next most crucial is years, and the least important is workdays. Among the various results, the maximum flow characteristics were found to be affected by the change in the overall conditions during 1975 (particularly a different daylight savings time and perhaps the reduced speed limit and other energy crisis factors). The morning congestion patterns and the time-sequence pattern of the flow-concentration trajectories were found to be relatively undisturbed during the 3-year period. The results may be useful when applied to problems of desirable flow and occupancy (concentration) under high demand level, estimated freeway capacities, sensitivity of an estimated capacity (capacity buffer), and traffic behavior during the peak period.

by Avishai Cedar; Adolf D. May
Technion-Israel Inst. of Tech., Road Safety Centre, Israel; University of California, Inst. of Transportation Studies, Berkeley, Calif.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p8-14
1977; 7refs
Availability: In HS-024 139

HS-024 142

PROCEDURE FOR ESTIMATING DEMAND FOR REGIONAL FRINGE PARKING FACILITIES

The purpose of this study was to determine the best location and the optimum feasible quantity of additional parking spaces that would effectively serve potential demand for change-of-mode parking at the interface between highway and passenger rail systems. Selection criteria, such as available land, accessibility to highway system, current rail ridership, and current parking demand, were used to identify 20 potential fringe parking sites. Future demand for parking spaces at the selected sites was determined in four steps. The first step dealt with trip interchanges; all future trip makers were able in the influence area of each of the potential sites, and whose trip destinations lie in the distribution service area of the passenger rail system, were identified and quantified. In the second step, the market share of each mode was calculated by using a disutility mode-choice model. Disutility rates for the automobile and rail modes were computed for each of the trip origin areas, and the percentage of passenger rail trips was derived from diversion curves. In the third step, the proportion of projected commuter rail patrons demanding parking spaces at each site was established by using a relationship between the distances patrons travel to the station and their access modes to the station. Finally, additional parking spaces over and

above the number of spaces already existing or planned were calculated for each site.

by R. K. Muftic; L. S. Golfin; C. D. Dougherty
Delaware Valley Regional Planning Commission, Philadelphia, Pa.

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p15-9

1977
Financed in part by Federal Hwy. Administration, Urban Mass Transportation Administration and Pennsylvania Dept. of Transportation.

Availability: In HS-024 139

HS-024 143

DESIGNING A PARKING MANAGEMENT PROGRAM

In order to reduce vehicle kilometers traveled, parking management measures are considered as a means to modify automobile-use patterns. Possible traveler responses to various parking control strategies, such as increased meter rates, parking bans, issuance of area permits, or taxes and surcharges, are discussed, with the implications of these responses for program design. Control of both on-street and off-street parking may be necessary in some areas. Flat per-hour parking rates are recommended as a reasonable compromise between the concerns of reducing vehicle travel and controlling the economic effects of parking policies. Since parking policy may be a product of many local interests, the coordination of efforts by local and regional agencies is critical.

by Ann B. Rappaport
Massachusetts Inst. of Tech., Center for Transportation Studies

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p19-25

1977; 9refs

Paper based in part on research conducted for Environmental Protection Agency.

Availability: In HS-024 139

HS-024 144

CRITICAL LANE ANALYSIS FOR INTERSECTION DESIGN

A new critical lane analysis is presented as a guide for designing signalized intersections to serve rush-hour traffic demands. Physical design and signalization alternatives are identified, and methods for evaluation provided. The procedures used to convert traffic volume data for the design year into equivalent turning movement volumes are described, and all volumes are then converted into equivalent through-automobile volumes. The critical lane analysis technique is applied to the proposed design and signalization plan. The resulting sum of critical lane volumes is then checked against established maximum values for each level of service to determine the acceptability of the design. Guidelines, a sample problem, and operational performance characteristics are provided to assist the engineer in determining satisfactory design alternatives for an intersection. Appended are individual comments by Stephen G. Petersen and Frederick A. Wagner, from the perspective of planning and operation engineers. The critical lane technique is accepted as a valuable tool, though its effectiveness is lost when correction factors and selection of different phasing arrangements transform too many steps into

variables. Potential refinements are suggested to make the analysis technique more precise.

by Carroll J. Messer; Daniel B. Fambro
Texas A and M Univ., Texas Transportation Inst.

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p26-35

1977; 8refs

Includes discussion by Stephen G. Petersen and Frederick A. Wagner, (Alan M. Voorhees and Associates, Inc.) and author's closure.

Availability: In HS-024 139

HS-024 145

REVIEW OF ROAD TRAFFIC NETWORK SIMULATION MODELS

Nineteen computer traffic simulation models, of the network class, are grouped into ten obsolete models, six traffic network models suitable for current computers, and the simulation portions of three signal optimization programs. Most of the simulation models discussed are fully microscopic, storing a specific location, speed, and acceleration for each individual vehicle. The vehicles engage in car following, i.e. the speed is determined by the speed of the vehicle directly in front; otherwise it travels at its "desired" speed. A brief description of the operating principles and unique features of each model is given, and the level of modeling detail, model flexibility, and usefulness of the output are assessed. Validation efforts on the model are considered, and, where known, computer language, type of machine, core requirements, and speed of execution are given.

by Paul Ross; David Gibson

Federal Highway Administration

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p36-41

1977; 44refs

Availability: In HS-024 139

HS-024 146

SIMULATION OF BUS LANE OPERATIONS IN DOWNTOWN AREAS

An investigation of potential operational capacities of downtown bus lanes was carried out in Ottawa, Canada. The results could improve coordination between bus priority treatments within downtown areas and those on the major transit corridors feeding the downtown areas. A description is given of the simulation model that was developed during the course of the study to simulate bus behavior in a downtown bus lane. Several operating strategies were tested and evaluated. The most effective was one employing alternating bus stops to increase the average bus stop spacing from 600 to 1200 feet; buses on half the routes stop in blocks 1, 3 and 5 while those on the other routes stop on 2, 4 and 6. A flow rate of about 160 buses/h and a good quality of service is yielded. Other strategies, such as platooning, where three or more buses proceed through the system as a group, or a strategy permitting buses to overtake but banning right turns by other vehicles from the common section, achieve higher bus volumes but at the cost of lower average speeds. Depending on the strategy selected, a bus flow rate of 150 to 170 buses/h can be achieved, and can accommodate 8000 to 9000 passen-

gers/h with acceptable loading standards, operating speeds, and existing standard equipment. Further tests and research are suggested.

by R. W. Bowes; J. Van der Mark
De Leuw Cather, Canada, Ltd.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977
p41-4
1977; 5refs
Availability: In HS-024 139

HS-024 147

MICROSCOPIC TRAFFIC SIMULATION PACKAGE FOR ISOLATED INTERSECTIONS

The Center for Hwy. Res. at the Univ. of Texas at Austin has developed a new microscopic traffic simulation package, called the traffic experimental and analytical simulation (TEXAS) model, that can be used to evaluate existing or proposed intersection designs and to assess the effects on traffic operations of changes in roadway geometry, driver and vehicle characteristics, flow conditions, intersection control, lane control, and signal timing plans. A geometry processor calculates vehicle paths on the approaches and in the intersection, identifies points of conflict between intersection paths, and determines minimum available sight distance along each inbound approach. A driver-vehicle processor generates individual driver-vehicle units and describes their characteristics. An auxiliary headway distribution analysis processor helps select an appropriate headway distribution. A simulation processor simulates the movement of each driver-vehicle unit through the system and gathers performance statistics. Linear acceleration and deceleration models and a noninteger, microscopic, generalized car-following equation are used. Traffic signal simulators are included for pretimed, semi-actuated, and fully actuated controls. Other intersection control options include no control and yield, less-than-all-the-way stop, and all-way stop signs. New simulation techniques include lane change decision and geometry, sight distance restriction checking, intersection conflict checking, and storage management and logic processing methods. A new field device for recording validation data and for determining suitable model input is described. Input was designed to be user oriented and minimal; output is concise and functional. Documentation has been developed for both users and programmers.

by Thomas W. Rioux; Clyde E. Lee
University of Texas at Austin, Center for Hwy. Res., Austin, Tex.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977
p45-51
1977; 18refs
Research conducted for Texas State Dept. of Highways and Public Transportation, in cooperation with Federal Hwy. Administration.
Availability: In HS-024 139

HS-024 148

POSTOPTIMALITY ANALYSIS METHODOLOGY FOR FREEWAY ON-RAMP CONTROL

Postoptimality analysis, concerned with changes in an optimum decision value caused by changes in the parameters (input data) of a decision model, is one way of approaching is-

sues of uncertainty when using deterministic techniques such as linear programming (LP). The technique is presented for applying LP to freeway on-ramp control, using a section of the Eastshore Freeway (I-80) in the San Francisco Bay area. Roadway and traffic data included the capacity profile of the freeway, 15-min origin-destination tables, and metering rate limits; the analysis concerns one 15-min interval of the afternoon peak period. An efficient upper-bounding LP algorithm and the methodology as presented were computerized and integrated into a new software system called freeway responsive control optimization techniques (FRESCOT), an ANS FORTRAN traffic-management package for freeway on-ramp control. The LP technique bases its calculations on point estimates rather than on a range of values. Postoptimality analysis assists in determining the importance and effects of deviations from such estimates. In addition to the optimum control strategy for the original (or initial) data set, the analyst is provided with valuable information concerning the deviations from the initial capacity and upper bound estimates. Not only are ranges of optimality given with their associated changes in the value of the objective function, but the corresponding control strategies are also provided. The expense of generating this information is practically negligible. Only simple calculations are required, and the computerization of these calculations can be considered as a one-time effort. The methodology developed is also applicable to priority-entry LP on-ramp control. Expansion of the FRESCOT software system to account for priority entry schemes has been initiated.

by Menahem Eldor; Ilan Adler
Technion - Israel Inst. of Tech., Transportation Res. Inst.; Univ. of California, Operations Res. Center, Berkeley, Calif.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977
p51-3
1977; 6refs
Abridgment.
Availability: In HS-024 139

HS-024 149

AREAWIDE IMPACT OF TRAFFIC CONTROL DEVICES

A study was made of the wide-range effects of traffic control changes in Philadelphia from 1968 through 1976. Two geographically distinct but geometrically similar areas were selected, in which the traffic control device itself was the only variable. Total intersections were 449 in one area and 444 in the other, 20% of the city's traffic signals and four-way stops. In 1973, 1500 manual, vehicle classification, turning movement, intersection counts and 1000 7-d, 24-h automatic traffic recorder counts were conducted in both areas. A total of 19,492 police dept. accident records for 1969-1976 were analyzed; the results are summarized. An evaluation is given of the before-and-after statistics at all locations where the control mode changed during the period. Results for the 222 two-way to four-way conversions in dangerous locations (accident rate of nine) indicated that results were similar in both areas under study; three of every four conversions from two-way to four-way stops improved conditions, but half of the safe two-way to four-way conversions increased accidents; six of seven dangerous two-way conversions reduced accidents; total accidents decreased by 55% after conversions to four-way stop; occupant personal injury accidents decreased by 81% after conversion; pedestrian injury accidents decreased by 83% after conversion; right-angle accidents decreased by 83% after

end, fixed-object, and sideswipe accidents.

by James J. Schuster
Ph.D., Philadelphia, Pa.; Villanova Univ.,
Studies
-644), "Highway Capacity, Traffic
Control Devices," Washington, D.C., 1977

139

AL-TIME DIVERSION OF C FOR SPECIAL EVENTS

In Jul 1976, freeway traffic bound for a
diverted to an alternate arterial route in
many candidate messages and displays
from laboratory studies of human factors.
The messages were displayed at alternate
locations on the Central Expressway.
so that the two sign messages were so
a driver saw only one, the information
on message 2 simply indicated on the
information concerning the best route would be
the sign. The first message caused 56.2%
and the second 43.8%; on the average,
diverted when a message was displayed.

Conrad L. Dudek; Donald R. Hatcher;

Texas Transportation Inst.
-644), "Highway Capacity, Traffic
Control Devices," Washington, D.C., 1977

Project conducted by Texas Transportation
Federal Hwy. Administration.
139

N PARAMETERS: OR TRAFFIC CONTROL

low in the Baltimore Harbor Tunnel, it
agree, length and frequency of platoon
the control alternatives used. A pre-
was installed, and two traffic signal
phases of 120, 160, 180 and 240 s; seven
options were included in each lane. Time
way and velocities are obtainable; in-
be identified and traced through the tun-
that the platoon parameters (average
platoon concentration and distribution of
side a simple and effective methodology
control alternatives; that the no-control,
alternatives yielded high and almost
cities through the tunnel; and that the
established that in some platoon concen-
trations one alternative predominated. A

control policy utilizing the no-control, the 120-s, and the 160-s
alternatives is proposed.

by Jose L. Rodriguez; Roy C. Loutzenheiser
Consultores Tecnicos Asociados, Hato Rey, P.R.; Greater
Southwest Regional Planning Commission, Garden City, Kans.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic
Flow, and Traffic Control Devices," Washington, D.C., 1977
p62-4
1977; 8 refs

Sponsored by Maryland State Hwy. Administration and
Federal Hwy. Administration. Res. performed while Mr.
Loutzenheiser was with Dept. of Civil Engineering, Univ. of
Maryland.
Availability: In HS-024 139

HS-024 152

COMPARISON OF TWO TYPES OF LEFT-TURN CHANNELIZATION

Driver performance at selected sites under two types of left-
turn markings was investigated to determine which type of
marking produced better driver performance. Type A showed
only an open entry space for access to the left-turn lane; Type
B had two solid yellow lines in the form of parallel reverse
curves to identify the proper path. After the data for Type A
had been collected the markings were changed to Type B at
each location, illustrating the turning movement from an arteri-
al to a collector street and from an arterial to an arterial street.
Conclusions were that driver performance did not differ sig-
nificantly between the two types of markings for turns made
into collector streets. When turning movements were executed
into an arterial street, Type B marking produced better driver
performance, as it also did at night. Type B is therefore
recommended for use over Type A.

by Judy C. Chang; Judson S. Matthias; Mary R. Anderson
Arizona State Univ., Dept. of Civil Engineering
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic
Flow, and Traffic Control Devices," Washington, D.C., 1977
p64-6
1977; 1 ref
Availability: In HS-024 139

HS-024 153

ACCIDENT EXPERIENCE WITH RIGHT TURN ON RED

A report is given on six separate studies on accidents as-
sociated with right turn on red (RTOR) conducted in Virginia
and Colorado and in the cities of Denver, Chicago, Dallas and
Los Angeles. In Virginia and Colorado before-and-after studies
were performed; in the other locations records were analyzed
to determine both the number of accidents and the causes. The
accidents related to RTOR appear to be very infrequent com-
pared with all intersection accidents (0.4% vs. 3.3%). The
Chicago and Virginia studies do not reveal a statistically sig-
nificant increase in intersection accidents; no fatalities were
found in the entire accident data base. Based on results of the
accident analyses, RTOR-related accidents are less severe than
the average intersection accident, and also tend to have less
property damage. The most common RTOR accident types
are: collision with a vehicle moving on green in the cross
street; with a vehicle making a left turn from the opposite ap-
proach on a left-turn phase; a rear end collision when a vehi-
cle making a RTOR stops abruptly; and a RTOR vehicle

hitting a pedestrian crossing the intersection. Two other infrequent accident types are two RTOR vehicles sideswiping, and the RTOR vehicle causing an accident to others.

by Hugh W. McGee

BioTechnology, Inc., Falls Church, Va.

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p66-75

1977; 10refs

Based on a study performed for Federal Hwy. Administration while the author was associated with Alan M. Voorhees and Associates.

Availability: In HS-024 139

HS-024 154

DRIVER BEHAVIOR DURING THE YELLOW INTERVAL

A signalized intersection was studied to provide an understanding of driver characteristics during the yellow interval, to determine the ability of drivers to stop in time, and to present a method for determining the length of the clearance interval for urban intersections. At that intersection 816 close-decision vehicles were recorded, and the probability of stopping was plotted against the cube root of the distance from the stop line at the instant the signal turned yellow. Figures show the probability of stopping during the yellow interval, the probability of stopping as a function of velocity and distance from stop line, the log of probability of stopping as a function of distance and velocity, the distance of vehicle from stop line and approach velocity as a function of percentage stopping, the probability of stopping during yellow interval versus potential time to stop line, the cumulative frequency distribution of average deceleration rates for 166 stopping vehicles, and the probability of stopping during the yellow interval versus accepted deceleration rate. At the intersection studied, 37% of the vehicles entered and crossed after the 3.2-second yellow interval; 85% of the close-decision drivers chose both to stop at the intersection when they were farther than 30.5 m (100ft) from the stop line at the instant the signal turned yellow and to go through the intersection when they were within 3.1 m (43 ft) of the stop line. At a distance of about 20.4 m (67 ft) from the stop line, 50% stopped, and 50% went through. The average maximum deceleration rate accepted by the vehicles stopping most quickly is 9.7 ft per second per second. Drivers confronted with a close decision during the yellow interval will accept a deceleration rate of 6.5 ft per second per second 85% of the time. An equation is provided whereby the minimum length of the clearance interval can be calculated to service drivers' needs adequately and to meet law enforcement purposes.

by William L. Williams

Federal Hwy. Administration, Office of Development

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p75-8

1977; 3refs

an abridgment.

Availability: In HS-024 139

HS-024 155

OPTIMIZATION OF PRETIMED SIGNALIZED DIAMOND INTERCHANGES

A computer program is described that can determine the best strategy for a pretimed signalized diamond interchange to minimize the average delay per vehicle. The program, PASSER III, is one of a series developed for the Texas State Dept. of Highways and Public Transportation. All basic interchange signal phasing sequences, including all possible patterns from lead-lead, lag-lead, lead-lag, and lag-lag phasings, are evaluated. Interchange performance is evaluated by using average vehicle delay; exterior delay is calculated by Webster's delay equation, and interior delay is determined from deterministic delay-offset techniques. Minimum delay analyses of 18 sample problems were made. Many signalization phasing patterns were found to provide optimum operation over the set of problems evaluated. While four-phase overlap and three-phase timing plans were normally found to provide good operation, other signalization patterns may produce even better operation.

by Carroll J. Messer; Daniel B. Fambro; Stephen H. Richards
Texas A and M Univ., Texas Transportation Inst.

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p78-83

1977; 12refs

Sponsored by Texas State Dept. of Highways and Public Transportation in cooperation with Federal Hwy. Administration.

Availability: In HS-024 139

HS-024 156

VIRGINIA'S CRASH PROGRAM TO REDUCE WRONG-WAY DRIVING

Over a four-year period beginning in 1970, wrong-way incidents and accidents were reduced on Virginia's interstate highways by 50% and on noninterstate highways by 70%, probably the result of engineering measures and increased public awareness. Since 1975 an upward trend has been observed on interstate roads, while the downward trend has continued on noninterstate roads. The following engineering measures taken to reduce wrong-way driving are discussed: using reflectorized pavement arrows on ramps, eliminating pavement flares, providing stop lines across exit ramps near junctions with crossroads, continuing the pavement edge line across exit ramps, continuing double yellow lines on two-lane divided crossroads opposite exit ramps, reducing crossover width across exit ramps, adding guidance to local drivers on new interchanges, informing the driver of the geometry of the intersection before entering, and providing guidance for drivers at T-intersections without a crossover.

by N. K. Vaswani

Virginia Hwy. and Transportation Res. Council,
Charlottesville, Va.

Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p84-90

1977; 6refs

Financed by State of Virginia.

Availability: In HS-024 139

April 30, 1979

HS-024 161

HS-024 157

EFFECT OF FLASHING BEACONS ON INTERSECTION PERFORMANCE

Results are presented of a study on the operational effects of various types of continuously and vehicle-actuated flashing traffic control devices, performed at the Federal Hwy. Administration's Maine facility. Both electronic and manual data collection techniques were used. Five intersection and three advance warning device configurations were tested at the intersection of US-2 and Me-152. The use of continuously flashing intersection beacons along stopped approaches encourages speeds consistently lower than those achieved by STOP signs or vehicle-actuated intersection beacons. Certain vehicle-actuated advisory warning devices helped to reduce speed variance on major (nonstopped) approaches. A vehicle-actuated STOP AHEAD beacon caused drivers to begin braking sooner than they would without a beacon. Reduced speed variance was also noted when the advance warning beacon was used. These effects disappeared if there was a beacon at the downstream intersection.

by R. B. Goldblatt

KLD Associates, Inc., Huntington Station, N. Y.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p91-5
1977; 6refs
Sponsored by Federal Hwy. Administration.
Availability: In HS-024 139

HS-024 158

EFFECTS OF SIGNAL PHASING AND LENGTH OF LEFT-TURN BAY ON CAPACITY

A periodic scan computer simulation program, developed to investigate the effects of signal phasing and length of left-turn bay on capacity, was tested, and inputs (phase sequence, volume, cycle length, and length, of left-turn lane) were varied to evaluate their interrelationships under a range of conditions. Additional analysis was conducted by using a modified Poisson approach. The results show that, for a left-turn bay, traffic delay increases and signal capacity decreases when traffic interactions and flow blockages occur between left-turning and through vehicles. High left-turn volumes and short bay storage lengths experience the most severe reduction in capacity. Mathematical relationships were developed between reductions in left-turn capacity and geometric and traffic conditions, and design guidelines were provided to minimize capacity reductions. Judicious selection of signal phasing reduces the loss in capacity to some extent, although all phasings can experience large losses under some geometric conditions.

by Carroll J. Messer; Daniel B. Fambro

Texas A and M Univ., Texas Transportation Inst.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p95-101
1977; 5refs
Research project conducted by Texas Transportation Inst. and Texas State Dept. of Highways and Public Transportation, in cooperation with Federal Hwy. Administration.
Availability: In HS-024 139

HS-024 159

OPTIMIZING SETTINGS FOR PEDESTRIAN-ACTUATED SIGNAL CONTROL SYSTEMS

The performance of a pedestrian-actuated signal control system at isolated intersections in terms of traffic delay is characterized. Three optimization problems of signal setting are discussed: the minimization of average vehicle delay, of total delay of pedestrians and vehicle riders, and of the difference between average pedestrian delay and average vehicle delay. Tables are presented of optimum settings for vehicle priority operations, for equity operations, and for minimum total delay operations. Pedestrian green duration should always be set at its minimum requirement, 7 s plus the time needed for a pedestrian to cross the intersection. Setting of minimum vehicle green duration depends on intersection width and traffic flow. In general, broader intersections and heavier vehicle flows require longer minimum vehicle green duration.

by Feng-Bor Lin

Clarkson Coll. of Technology, Dept. of Civil and Environmental Engineering, Potsdam, N.Y.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C. 1977 p102-7
1977; 6refs
Supported by National Science Foundation.
Availability: In HS-024 139

HS-024 160

LEVEL OF SERVICE AT SIGNALIZED INTERSECTIONS

A method for quantifying the different levels of service at signalized intersections was developed with the use of a road-user opinion survey that involved depicting and rating different traffic situations at a single signalized intersection. Over 300 drivers rated randomly arranged film sequences of two types, a driver's view (microview) and an overall view (macroview) of an intersection, and evaluated these films, segment by segment, in terms of appropriate levels of service. Field studies and the attitude survey provided data for the development of two psychophysical models. Statistical analysis indicated that average individual delay correlated better with level of service rating than with measured load factor and encompassed all levels of service. Road users rated delay highest of the various parameters influencing levels of service at signalized intersections.

by T. C. Sutaria; J. J. Haynes

Rady and Associates, Inc., Fort Worth, Tex.; University of Texas at Arlington, Dept. of Civil Engineering, Arlington, Tex.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p107-13
1977; 19refs
Availability: In HS-024 139

HS-024 161

ESTIMATION OF UNPROTECTED LEFT-TURN CAPACITY AT SIGNALIZED INTERSECTIONS

A mathematical model was developed to calculate the unprotected left-turn capacity of a pretimed signalized intersection. The capacity depends primarily on the volume of traffic op-

posing the left-turn movement and the percentage of the cycle available for this maneuver. Parameters were determined from field studies conducted in several Texas cities. The model was used to estimate the unprotected left-turn capacity for approaches both with and without exclusive turn lanes. Opposing volumes ranged from 200 to 1000 automobiles/h in one, two or three lanes. Green splits from 30% to 70% of the cycle were analyzed. Unprotected left-turn capacities as predicted by the model and by the Highway Capacity Manual were compared. General agreement was found at a 50% green split; significant differences existed at other green splits.

by Daniel B. Fambro; Carroll J. Messer; Donald A. Andersen
Texas A and M Univ., Texas Transportation Inst.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977
p113-9
1977; 13refs

Research project sponsored by Texas State Dept. of Highways and Public Transportation, in cooperation with Federal Hwy. Administration.

Availability: In HS-024 139

HS-024 162

EFFECT OF DOTTED EXTENDED LANE LINES ON SINGLE DECELERATION LANES

Data collection to determine the effectiveness of the optional dotted extension of the right edge line for deceleration lanes included performing before studies, installing extended dotted lane lines, and performing after studies at 12 sites in New Jersey's interstate system. Extended dotted lane lines were installed from the gore point on tapered lanes and from the ends of skip-lines on parallel lanes, and upstream to the point where the edge line begins to taper at the beginning of the exit lane. The comparison of total exit maneuver rates by lane type for each study site shows a significant increase in the earlier, zone 1 exit maneuvers, after dotted lane lines were installed, and a corresponding decrease in later zone 2 exit maneuvers. No significant change was noted in before and after rates for zone 3 exit maneuvers on parallel deceleration lanes (crossing the painted gore regions). The dotted extension of a right edge line was more effective in orienting exiting traffic sooner into the deceleration lane, single tapered and parallel deceleration lanes. Exiting vehicles use the shorter deceleration lanes with less variation, because there is less room to maneuver.

by W. D. Keck; A. W. Roberts
New Jersey Dept. of Transportation
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977
p120-1
1977

An abridgment. Funded by Federal Hwy. Administration and state of New Jersey.

Availability: In HS-024 139

HS-024 163

EVALUATING LOCATION EFFECTIVENESS OF FREEWAY DIRECTIONAL AND DIVERSION SIGNS

The location of a single real-time information sign before a diversion point is critical and should be determined analytically. A model is presented, using gap acceptance concepts and considerations for safe maneuvering, to calculate the theoretical probability of completing a lane change, and to

evaluate the effectiveness of various sign locations. Characteristics of the lane-change distance-probability relationship are partly a function of traffic flow rates and speeds on the origin and destination lanes and driver's gap acceptance characteristics. The desired legibility distance of a sign is 19.5 m (65 ft) per 2.5 cm (1 in) of letter height for daylight conditions, assuming that drivers have 20/20 vision. The probability curves for the distance involved in a lane-change maneuver on a four-lane freeway provide a reasonable measure of effectiveness of sign location. Both the 1.6 km and 3.2 km signs are approximately the same in effectiveness; except for improving the visibility of the message, the contribution of the 3.2-km sign to the success of the lane-change maneuver is rather small. Improving these signs or changing locations with respect to exit points could reduce the number of signs needed. As to real-time diversion signs of 50 cm letter height on a four-lane freeway, the gain in effectiveness from locating a sign more than 0.4 km (0.25 mi) in advance of the diversion point is relatively small.

by Moshe Levin
Illinois Dept. of Transportation, Chicago Area Expressway Surveillance Proj.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977
p122-4
1977; 6refs
An abridgment.
Availability: In HS-024 139

HS-024 164

INFLUENCE OF CONTROL MEASURES ON TRAFFIC EQUILIBRIUM IN AN URBAN HIGHWAY NETWORK

Traffic control measures play a critical role in determining equilibrium between demand and supply in an urban highway network. Present techniques attempt to optimize network performance assuming a fixed demand pattern. Experience indicates that control measures can be used to influence demand patterns in such a way that total network performance is significantly improved. On the basis of the interdependence of control measures and resulting traffic flow patterns, an analytical framework is developed for a systematic optimization of the operation of a highway system. Two practical examples described demonstrate that determining control measures consistent with the traffic flow patterns is preferable to calculating control programs and flow patterns independently of each other. A nonlinear optimization program, based on the mixed-integer traffic optimization model, is presented to achieve this objective on a networkwide basis.

by Nathan H. Gartner
Federal Hwy. Administration
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977
p125-9
1977; 16refs
Availability: In HS-024 139

HS-024 165

OPTIMUM CONTROL OF TRAFFIC SIGNALS AT CONGESTED INTERSECTIONS

A theory is developed providing an analytical solution to the problem of optimum control of traffic signals at congested in-

tersections with queue length constraints. The oversaturated intersection can be formulated and treated as a control problem in which the system is the intersection, minimization of the aggregate delay subject to queue length constraints is the objective of the control, the queues on each approach to the intersection describe the state of the system, and cycle length and splits are bounded control variables. The major problem associated with the optimum control strategy is determining the switch points (if they exist), the final time, and the resulting minimum total delay. Because of the complexity of the problem, a numerical solution must be accepted, generated by a digital computer when nonlinearities are introduced (nonlinear time-varying demands). A closed form solution requires analytical expressions describing the history of arrivals that vary from intersection to intersection. The theory can be extended to more than two intersections; however, as the number of intersections increases or when a large number of queue length constraints are imposed, the optimum control policy becomes more complex, making it difficult to apply to a pretimed system, so that closed loop control (computer control) should be considered. In this case adaptive prediction algorithms are needed.

by Panos G. Michalopoulos
Rensselaer Polytechnic Inst., Troy, N.Y.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p129-31
1977; 9refs
An abridgment.
Availability: In HS-024 139

HS-024 166

SIMULATION AND CONTROL OF TRAFFIC ON A DIAMOND INTERCHANGE

Signaling strategies that control left-turning traffic on a diamond interchange are evaluated by simulation. Although the simulation and control strategies were designed for a particular interchange, each may be adapted to the intersection of other one-way pairs of arterials. The simulation method, the general purpose system simulation package, is briefly discussed, and four related control strategies are presented. Evaluation of these strategies based on average and maximum transit times through the interchange indicates that choosing signal features can significantly profit from the use of short-term average volume information. A flexible strategy based only on queue lengths gives good but not entirely satisfactory performance.

by C. H. Knapp; D. Ghosh; R. Jain
University of Connecticut, Dept. of Electrical Engineering;
Springfield Dept. of Traffic Engineering, Mass.
Publ: HS-024 139 (TRR-644), "Highway Capacity, Traffic Flow, and Traffic Control Devices," Washington, D.C., 1977 p132-7
1977; 5refs
Supported by Connecticut Res. Foundation and Connecticut Dept. of Transportation.
Availability: In HS-024 139

HS-024 167

USE OF BREATHALYZER SCORES IN THE EVALUATION OF PERSONS ARRESTED FOR DRIVING WHILE INTOXICATED

An assessment was made of the relationships between Breathalyzer-measured BAC (blood alcohol concentration) at the time of presentence diagnostic screening of persons arrested for DWI (driving while intoxicated), and self-reported alcohol use and clinical judgments about recent drinking. Since the BAC is usually measured only at the time of arrest, most data about the drinking habits of those arrested for DWI are based on self-reports and past arrest histories. Because persons facing sentencing may disclaim excessive alcohol use, the reliability of self-reports is dubious. The remeasurement of BAC when arrestees report their drinking histories might provide evidence for judging the veracity of the information which the DWI offender offers. It is concluded from the present study of a random sample of DWI offenders awaiting evaluation for referral by the courts to safe driving classes or to appropriate alcoholism treatment programs, that because of their moderate correlation with Breathalyzer measurements of BAC, self-reports and clinical judgments of alcohol consumption are unreliable. The majority of persons studied had wisely not imbibed prior to their interviews. To provide information about a person's usual alcohol consumption, BAC's would have to be measured randomly at any time of the day or night. Since such an arrangement is impractical, other methods have to be used to improve the validity of information on alcohol use. Experimentation with polygraph analyses, voice stress prints, projective techniques, and reports by disinterested observers may determine whether these methods yield valid estimates of DWI offenders' usual drinking behavior.

by Jesse Jalazo; Robert A. Steer; Eric W. Fine
Publ: Journal of Studies on Alcohol v39 n7 p1304-7 (1978)
1978; 9refs
Availability: See publication

HS-024 168

FIRE RESISTIVITY AND TOXICITY STUDIES OF CANDIDATE AIRCRAFT PASSENGER SEAT MATERIALS

Results are presented of fire resistivity studies conducted on 39 candidate materials for improved fire-resistant aircraft passenger seats. These materials were evaluated on the basis of Federal Aviation Administration (FAA) airworthiness burn and smoke generation tests, colorfastness, and animal toxicity tests, in addition to their physical, mechanical and aesthetic properties. The baseline materials screened were representative of materials currently in use on aircraft (baseline fabric consisting of 90% wool/10% nylon with a density of 457 g/m squared, baseline cushioning being a fire-retardant treated urethane foam with a density of 0.03 g/m squared). A new aircraft seat design concept is the fire-blocking layer, intended as a thermal barrier. It is not intended to compensate for cushioning materials that do not meet fire resistivity levels, but it insulates, provides mechanical enhancement of the tear strength of the foam cushion, and provides a smooth sliding surface for ease in installation of the fabric cover. Cushioning materials make up over half the weight of nonmetallics in an aircraft passenger seat, and from the flammability standpoint, polymeric foam materials present a challenge. The thermal response characteristics or fire resistivity of each seat com-

standard tests. The modified burn test for materials that melt or drip, and by so doing are removed from the flame, and the Pill test for cushioning or foam materials, represent a higher seat material standard than current FAA requirements. The baseline fabric and foam in current use were entirely consumed in the modified burn test, which more closely represents an actual fire situation. Some of the materials tested were in the developmental stage and it is possible that their thermal properties can be improved. New materials that can be commercially available by 1980 will continue to be evaluated in the program's next phase.

by Larry L. Fewell; Edward L. Trabold; Howard H. Spieth
NAS2-9337
Publ: Journal of Fire and Flammability v9 p377-402 (Jul 1978)
1978; 8refs
Availability: See publication

HS-024 169

TEST DRIVING YOUR EDUCATION [OFF-ROAD RACE CAR ENGINEERING COMPETITION FOR COLLEGE STUDENTS]

Two engineering students relate their experience as participants in the 1978 Mini Baja Competition, a contest sponsored by the Society of Automotive Engineers to provide an opportunity for engineering undergraduates to put some of their classroom knowledge to work on a small, one-man, off-road race car. Each participant was provided with an 8-hp Briggs and Stratton engine, and a list of design requirements and constraints to make the experience as close as possible to a true industrial design problem. Each vehicle was required to use the engine, unmodified; had to be capable of carrying a 6' 3" adult weighing 250 lb; had to have a total computed manufacturing cost of \$700 or less; had to be safe, reliable, and marketable; and had to be designed to be easily produced with standard machine tools, from standard materials, and by semi-skilled workers. Twenty-one entrants showed up at Arizona State Univ. (Florida Technological Univ. was a second host site) for the four-part contest: a static display competition, acceleration test, maneuverability test and 35-mile endurance test.

Publ: Trend in Engineering v30 n3 p5-7 (Summer 1978)
1978
Availability: See publication

HS-024 170

TIRE DIMENSIONS. PROPERTIES OF WIDE AND LOW VERSUS NARROW AND HIGH TIRES

Available literature dealing with dimensional influence on tire performance was studied, in order to examine the characteristics of a tire of extremely small width and large overall diameter. Results from a Swedish research project "Tire Noise-Influence of Tire and Road Surface" had indicated that it should be possible to construct tires with less noise generation by accepting a radical change in dimensions (narrower and higher tires than normal, the opposite of the present trend towards wider and lower tires). Relevant experimental data were found to be rare, and definite conclusions regarding dimensional influence were difficult to make. Results show

wear, lower center of gravity, decreased space requirements and somewhat lower unsprung mass; the alternative tire (aspect ratio 100%, increased radius, decreased width) had increased dynamic and viscous hydroplaning limits, improved security on roads covered with snow slush, improved ride (comfort), less splash and spray generation, and easier braking design. Overall, none of the studied dimensional alternatives seems noticeably better or worse than the other, and the ultimate choice depends on how their respective qualities are valued. The present trend towards lower and wider tires, influenced by "styling" considerations, merits further discussion.

by Ulf Sandberg; Carl Formgren; Evert Ohlsson
Statens Vag- och Trafikinstitut (VTI), Fack 58101 Linköping, Sweden
Rept. No. VTI-108A; 1976; 24p 47refs
Sponsored by Styrelsen for Teknisk Utveckling (Swedish Board for Technical Devel.). Includes Swedish summary.
Availability: Corporate author

HS-024 171

GASOLINE CONSUMPTION FOR THE CAR FLEET OF TOMORROW

Some of the problems and uncertainties that refiners are likely to meet in trying to satisfy future U.S. gasoline demand are reviewed. During the next eight years (to 1985), motor gasoline consumption is expected to increase slightly, level off, and then begin a slow decline. The proposed National Energy Policy may result in an even faster decline in gasoline sales if it is approved by the Congress. Over the same period, the required gasoline pool octane will increase in response to increased unleaded gasoline sales, the Environmental Protection Agency's lead phase-down schedule, and predicted engine modifications for improved efficiency. To meet tomorrow's gasoline needs, refiners must expand refinery capacity, make major changes to the typical process mix, and greatly expand octane-producing capability. All of these tasks can be accomplished with disruption of supply, but only if the government adopts realistic policies that will provide the incentives necessary to attract needed capital, and if needed construction is not delayed by unnecessary environmental roadblocks.

by R. M. Ormiston; G. G. Pollock
Standard Oil Co. of California
Rept. No. SAE-770670; 1977; 10p
Presented at International West Coast Meeting, Vancouver, B.C., 11 Aug 1977.
Availability: SAE

HS-024 172

TRAFFIC CONGESTION, TYPE A BEHAVIOR, AND STRESS

A quasi-experimental study was conducted to assess the effects of routine exposure to traffic congestion on the mood, physiology, and task performance of automobile commuters. Traffic congestion was conceptualized as an environmental stressor that impedes one's movement between two or more points. Sixty-one male and 39 female industrial employees were assigned to low-, medium-, or high-impedance groups on the basis of the distance and duration of their commute and were classified as either Type A (characterized by extremes

competitiveness, impatience, and job involvement; highly predictive of coronary heart disease) or Type B (noncompetitive, patient, relaxed; much less likely to be associated with heart disease). As expected, subjective reports of traffic congestion and annoyance were greater among high- and medium-impedance commuters than among low-impedance individuals. Commuting distance, commuting time, travel speed, and number of months enroute were significantly correlated with systolic and diastolic blood pressure. Contrary to prediction, medium-impedance A's and high-impedance B's exhibited the highest levels of systolic blood pressure and the lowest levels of frustration tolerance among all experimental groups. On the whole, the findings indicate that routine exposure to traffic congestion is associated with significant differences in the mood, physiology, and task performance of commuters. Moreover, while providing preliminary support for the idea that traffic congestion causes stress, the present research suggests for further study the development of behavioral criteria of impedance (e.g. braking frequency during commute), monitoring of commuters' behavior and physiology while traveling and after completion of commute, and determination of whether the effects of travel conditions on arousal and task performance are accompanied by behavioral adaptations (e.g. change of residence, participation in carpools, purchase of a more luxurious car) or by long-term decrements in health status to the extent that such coping strategies are not used. The study results offer partial construct validation of the coronary-prone behavior pattern and suggest its importance in mediating the impact of traffic conditions on commuters.

by Daniel Stokols; Raymond W. Novaco; Jeannette Stokols; Joan Campbell

Publ: Journal of Applied Psychology v63 n4 p467-80 (Aug 1978)

1978; 51refs

Presented in part at American Psychological Assoc. meeting, San Francisco, Aug 1977. Research sponsored by Univ. of California, Irvine, Inst. for Transportation Studies.

Availability: See publication

HS-024 173

APPLICABILITY OF DRIVERS' ELECTRODERMAL RESPONSE TO THE DESIGN OF THE TRAFFIC ENVIRONMENT

Electrodermal response, heart rate, and muscular activity were measured for 60 subjects driving a rural test route. Brake pressure and steering-wheel angle were also recorded, and traffic events encountered were categorized by the experimenter using a keyboard. Seven million data points were obtained and stored on a digital tape recorder in the test vehicle. Traffic-event categories were then rank ordered according to magnitude of response. For electrodermal response and brake pressure, a Spearman rank correlation coefficient of .95 was obtained. Time-sequence analyses of the drivers' physiological responses and motor activity show that electrodermal responses are induced by the mental effort of the driving task rather than the physical effort necessary to maneuver the vehicle. The results have ergonomic implications for highway design. The importance for traffic safety of continuity of road quality is shown. Because using the brake is perceived as stressful, highway design minimizing braking should be preferred. This

could readily be adopted by design engineers, since the practical implications are easy to evaluate.

by Martin Helander

Publ: Journal of Applied Psychology v63 n4 p481-8 (Aug 1978)

1978; 22refs

Availability: See publication

HS-024 174

ALCOHOL, AUTOMOBILES AND THE SEARCH FOR MENS REA: IS AN HONEST MISTAKE A GOOD DEFENCE? [CANADIAN LAW REGARDING DWI (DRIVING WHILE INTOXICATED) CASES]

In at least two Canadian provinces (British Columbia and Manitoba), courts have held that neither hotel breathalyzers nor government alcohol charts can be relied upon by an accused DWI (driving while intoxicated) offender whose defense to a charge under Section 236 of the Criminal Code is that he/she honestly believed his/her blood alcohol level (BAL) was below the statutory limit. The question is raised of whether the courts, by restricting the defense of mistake in this way, are treating the offense created by Section 236 as a special case. In the case of Regina vs. Penner (Manitoba Court of Appeal, 1974), Mr. Penner contended that he had mistakenly relied upon a chart (distributed to the public by the Manitoba government) which led him to expect that the amount of alcohol he had consumed was insufficient to raise his BAL above the statutory limit. The gist of the court's reasoning in this case was that the defendant's reliance on the chart was unreasonable, hence he could not make out a defense of absence of mens rea (guilty mind). It has long been established that in the absence of express statutory provisions to the contrary, mens rea must be proved by the Crown before an accused person can be convicted of a crime. In the Penner case, the Court accepted the honesty of the defendant's belief about his alcohol consumption but went on to reject the defense on the ground of unreasonableness. The Court stressed the fact that the government alcohol chart is a guide only, that Mr. Penner could not shift his responsibility by relying upon it, that the chart is a "misguided attempt" to aid citizens in the discharge of their duty under the law, and that even though Mr. Penner expected his BAL to be below the legal limit, he could not rely on the chart to negate the mens rea, required to constitute the offense. In other words, his honest reliance upon the chart was unreasonable. It is felt that the result in the Penner case is not only bad policy, but also inconsistent with authority and wrong in principle. If a trial judge finds as a fact that an accused person foolishly but honestly believed that the proper steps had been taken to remain within the law, the authorities seem clear that, so long as the mistake is one of fact and not of law, that person has not the guilty mind required for conviction. Until governments cease publishing alcohol consumption charts or prohibit hotel breathalyzers, or until Parliament expands the prohibitions contained in Sections 234 and 236, those few who are unfortunate enough to rely upon such aids should not be branded criminals.

by Hamar Foster

Publ: Manitoba Law Review v8 p521-7 (1977)

1977; refs

Availability: See publication

HS-024 176

HSL 79-04

HS-024 176

AUTOMOTIVE STIRLING ENGINE DEVELOPMENT PROGRAM. QUARTERLY TECHNICAL PROGRESS REPORT, OCTOBER 1977--DECEMBER 1977

The first three months effort is reported for the Ford/DOE (Dept. of Energy) Automotive Stirling Engine Devel. Prog., specifically Task 1 (Fuel Economy Assessment) progress. Task 1 covers the first year's effort to perform certain analyses and component development work to determine whether the fuel economy objective established for the Fourth Generation Stirling engine (30% improvement) can be achieved. To accomplish this objective, durability upgrading of the current Stirling engine is required. As of 19 Sep 1977, the projected fuel economy of the 4-215 Stirling engine was 21.16 mpg with a confidence level of 29%. Since that date, the fuel economy improvement projection of the engine has been increased to 22.11 mpg, with a 29% confidence level. Collection of fuel economy improvement data is directly related to engine durability. During the first three months of the program, engine durability has been limited. Since 19 Sep 1977, a total of 47.7 hours of engine running time has been accumulated using two engine builds, engine 1X17 and 3X16.

by Ernest W. Kitzner

Ford Motor Co., Alternate Engines Res. Dept., Dearborn, Mich. 48121

DOE-EC-77-C-02-4396

Rept. No. CONS/4396-1; NASA-CR-135331; QPR-(Oct-Dec)-77; N78-22970; 1978; 93p

Project management by National Aeronautics and Space Administration, Lewis Res. Center, Cleveland, Ohio 44135 (Interagency agreement EC-77-A-31-1040).

Availability: NTIS

HS-024 177

URBAN INTERSECTION IMPROVEMENTS FOR PEDESTRIAN SAFETY. VOL. 3. SIGNAL TIMING FOR THE PEDESTRIAN. FINAL REPORT

In this second phase of a three-phase project studying pedestrian safety at urban intersections, an examination was made of the timing of pedestrian WALK/DONT WALK signals from the perspective of safety and delay for both pedestrians and vehicles and an attempt was made to develop procedures which would make signal timing more responsive to the needs of both groups. Three major areas of research with subcategories) were analyzed: timing for a combined pedestrian-vehicular interval (minimum WALK time, minimum clearance interval, allocation of excess pedestrian time), alternative phasing schemes (early and late release of pedestrians with respect to vehicles, "scramble" pedestrian timing, signal phasing for the partial crossing of wide, channelized streets), and other areas of pedestrian signal research (time of day adjustments of pedestrian signal timing, application of correction factors to the "Highway Capacity Manual" based on vehicle and pedestrian activity levels, general observations on pedestrian flow characteristics). For each of the above topics, the study approach is outlined, and the data collection and analysis procedures are described. The substantial amount of data included samples taken in several areas of the U.S., the three primary locations being Washington, D.C., Buffalo, N.Y., and Phoenix, Ariz. Several unique analysis procedures

have been used to mold these data into usable concepts, and procedures have been developed for wide application.

by C. M. Abrams; S. A. Smith

BioTechnology, Inc., 3027 Rosemary Lane, Falls church, Va. 22042; JHK and Associates, 4660 Kenmore Ave., suite 1112, Alexandria, Va. 22304

DOT-FH-11-8533

Rept. No. FHWA-RD-77-144; 1977; 178p 16refs

Rept. for Jun 1974-Jun 1977. Vols. 1-2 are HS-024 117--HS-024 118; Vols. 4-5 are HS-024 119--HS-024 120. Subcontracted to JHK and Associates.

Availability: NTIS

HS-024 178

DISCUSSIONS AND AUTHOR CLOSURES ON THE RELATIONSHIP BETWEEN ENGINE OIL VISCOSITY AND ENGINE PERFORMANCE (SP-416)

Discussions of several previous Society of Automotive Engineers (SAE) papers on the relationship between oil viscosity and engine performance, and authors' replies, are provided, as a supplement to SAE-SP-416, ASTM-STP-621, which included all the papers presented at the SAE-ASTM (American Society for Testing Materials) Symposium held during the 1977 SAE International Automotive Engineering Congress and Exposition, Detroit, 28 Feb-4 Mar 1977. The purpose of the Viscosity/Engine Symposia was to help develop information for the restructuring of the SAE J300c Engine Oil Viscosity Classification.

by Ross M. Stewart; Ted W. Selby

Gulf Science and Technology Co.; Savant, Inc.

Rept. No. SAE-770628; 1977; 22p 17refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977. For basic papers, see HS-020 527.

Availability: SAE

HS-024 179

AN UPDATE ON SYNTHESIZED ENGINE OIL TECHNOLOGY

Utilizing extensive synthesized hydrocarbon fluid (SHF) technology, a superior quality, light-viscosity automotive engine oil has been developed providing optimized engine performance. This SAE 5W-20 product employs a blend of a selected olefin oligomer base with a selected ester, and a specially designed additive package. It has been shown to provide significant fuel-economy benefits, normal to improved oil economy, engine cleanliness, and wear protection. In the past, this level of performance has not been possible using conventionally-refined mineral oils. The superior performance of SAE 5W-20 is extensively documented in U.S. and European laboratory engine, chassis dynamometer, and field tests. Fuel-economy benefits are shown for a wide variety of vehicles under a number of test conditions including both chassis dynamometer and over-the-road field testing. The performance reserve capabilities of this product are demonstrated by the results of extended-drain field tests and extended-duration API (American Petroleum Inst.) sequence engine tests. Relevant factors are discussed which illustrate considerable energy conservation can be obtained through properly-formulated synthesized engine oils. For today's and future passenger car engines, synthesized products offer the best potential for

April 30, 1979

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providing the consumer with the most trouble-free performance.

by J. A. C. Krulish; H. V. Lowther; B. J. Miller
Mobil Oil Corp.

Rept. No. SAE-770634; 1977; 20p 19refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.

Availability: SAE

HS-024 180

ANTI-WEAR PROPERTIES OF ENGINE OILS-- EFFECTS OF OIL ADDITIVES ON VALVE TRAIN WEAR

Special test methods under low temperature/low speed and moderate temperature/moderate speed operating conditions were devised to evaluate the antiwear properties of engine oils (commercial and test) with respect to overhead camshaft (OHC) valve-train wear. The results obtained show a good correlation with fired-engine tests under either constant-speed or cyclic-speed test conditions. Low temperature/low speed conditions were found to be more severe for valve-train wear, especially for tappet scuffing. Some engine oils with lower levels of Zn-DTP (zinc dialkyldithiophosphate) antiwear additive were superior with respect to valve-train wear than those with higher levels of Zn-DTP. High concentration of barium phosphonate detergent additive caused tappet scuffing under moderate temperature conditions, and the presence of magnesium sulfonate detergent additive caused tappet scuffing under low temperature conditions. Ashless-dispersant chemistries of succinate ester caused heavy tappet scuffing. Engines with different designs and/or materials showed the same severe effects with respect to valve-train wear under the low temperature/low speed operating conditions. Tappet scuffing under low-temperature operating conditions shows a rather good correlation with valve-lifter pitting in the OHV (pushrod-operated valve gear) engine.

by Kyoze Torii; Hitoshi Chida; Katsuji Otsubo; Yoshihiko Tsusaka

Toyota Motor Co., Ltd. (Japan)

Rept. No. SAE-770635; 1977; 20p 14refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.

Availability: SAE

HS-024 181

CAM AND FOLLOWER PERFORMANCE PREDICTION OF LUBRICANTS IN A TEST RIG

Methods are described of using the CEC (Coordinating European Council) cam and follower rig to predict lubricant performance in hydraulic lifter, finger follower, and bucket follower valve-train mechanisms, of differing metallurgies. The equipment and methods described are one laboratory's approach to investigation of this aspect of lubricant technology. Steady-condition, step-load testing was the essence of 20-hr tests to predict antiwear performance of lubricants on the basis of highest nonfail loads, and this was applied to hydraulic lifters and to finger followers. Pitting performance was evaluated in a different metallurgy using a 50-hr test at a single set of overload conditions. Results indicate an ability to discriminate between reference oils of known antiwear performance in field testing. Oils treated with wholly alkyl zinc

dithiophosphate (ZDP) gave better wear protection for hydraulic lifters and cams than those treated with mixed alkyl/aryl or wholly aryl ZDP additive. Even relatively low treatment levels of alkyl ZDP gave better performance in the test rig than an intermediate performance blend with mixed ZDP treatment. A conventional alkyl ZDP SE-type blend and low phosphorous SE-level experimental blends both favorably compare with the reference oils. Adequate to good performances in pitting tests with the two types of blend are also encouraging.

by J. V. D. Wilson; S. F. M. Samy

Edwin Cooper and Co. Ltd., U.K.

Rept. No. SAE-770636; 1977; 10p 8refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.

Availability: SAE

HS-024 182

ENGINE OIL PHOSPHORUS EFFECTS ON CATALYTIC CONVERTER PERFORMANCE IN FEDERAL DURABILITY AND HIGH-SPEED VEHICLE TESTS

Phosphorous (P) derived from engine oil adversely affected catalyst performance monitored in two separate vehicle tests. In the first test, conducted using six matched vehicles operated at high-speed conditions (High-Speed Driving Schedule (HSDS)) with three different commercial engine oils (with P concentrations of 0.065 wt%, 0.17 wt%, and 0.21 wt%), catalyst hydrocarbon (HC) conversion efficiency decreased with both the amount of P added to the engine, and that found on the catalyst. In the second test, conducted using four matched vehicles operated on two (with P concentrations of 0.08 wt% and 0.17 wt%) different commercial engine oils using the Federal Durability Driving Schedule (FDDS), HC conversion efficiency also decreased linearly with the same P parameters. In this latter test, for nominal oil economies (3400 km/l) and P concentration found in current oils (0.17 wt%), catalyst deterioration resulting from P poisoning was greater than that resulting from thermal degradation and could adversely affect a vehicle's ability to pass current (1977) and future emission standards. Accordingly, any changes in engine design, oil formulation, or service recommendation should be considered from the standpoint of the amount of engine-derived P which will reach and poison the catalyst.

by J. A. Spearot; F. Caracciolo

General Motors Corp., Res. Labs.

Rept. No. SAE-770637; 1977; 19p 12refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.

Availability: SAE

HS-024 183

THE USE OF ISOTHERMAL PLUG FLOW REACTORS FOR EXHAUST HYDROCARBON REACTION STUDIES

Methods used for the study of the kinetics of exhaust hydrocarbon (HC) reactions are reviewed, compared, and contrasted. The isothermal plug flow reactor which allows the determination of time-resolved concentration histories of reactants, intermediate products, and final products is suggested as, perhaps, the most desirable and versatile system for the study of moderate-temperature HC oxidation reactions. The

isothermal plug flow reactor allows the gas-phase reactions to be studied with kinetically well-defined, repeatable, homogeneous reaction conditions that are essentially free of heterogeneous interference. Because of the detailed data obtainable and the controlled reaction conditions, kinetic mechanisms can be studied and evaluated. Results from these isothermal studies can lead to both a better understanding of the mechanisms of HC oxidation and the complex interactions encountered in the final stages of HC reactions in automotive exhaust gas. Investigations that have used the isothermal plug flow reactor technique are reviewed and examples cited to demonstrate the unique capabilities of this technique.

by R. W. Deller; S. C. Sorenson
University of Texas at Austin, Dept. of Mechanical Engineering, Austin, Tex.; University of Illinois at Urbana/Champaign, Dept. of Mechanical and Industrial Engineering, Urbana/Champaign, Ill.
Rept. No. SAE-770638; 1977; 16p 45refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 184

RATES OF EXHAUST GAS-AIR REACTIONS

An investigation was undertaken to determine rate expressions, kinetic rate coefficients, and constants, for the overall reactions of exhaust gas and air that take place under conditions existing in engine exhaust reactor systems. Actual exhaust gas was generated in situ by a spark ignition engine. The gas was then mixed and reacted with air in a tubular reactor, whose diameter, flow rates, and temperatures of operation were of the same order of magnitude as those found in experimental engine exhaust reactor systems designed to reduce exhaust gas emissions. Rate expressions are given for the overall reactions of carbon monoxide, hydrogen, and total hydrocarbons (HC). It was observed that nitric oxide had a sensitizing effect on the ignition in the reactor. On the other hand, some HC, specifically isobutane, inhibited the ignition. It is suggested that research should be extended to determine quantitatively the sensitizing and inhibiting effects associated with nitric oxide and different HC, for various levels of concentrations, and to cover all ranges of operating parameters.

by J. L. Bascunana; J. Skibinski; E. E. Weaver
Ford Motor Co., Product Planning and Res.
Rept. No. SAE-770639; 1977; 12p 9refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977. Sponsored by Inter-Industry Emissions Control (IIEC) program.
Availability: SAE

HS-024 185

COMPRESSION RATIO EFFECTS WITH LEAN MIXTURES

Tests were conducted on two car makes to explore ways of retaining all or part of the traditional gains in fuel economy resulting from a higher compression ratio (CR) while holding hydrocarbon (HC) emissions near 1.2 g/mi and nitrogen oxides (NOx) emissions below 2 g/mi. For one car make, exhaust port liners were installed in both the production and high-compression versions. For the other make, exhaust port liners were used in the high-compression version only to offset the HC increase that occurs when CR is increased. Additional tests were

made with one of the car makes using thermal reactors to control HC emissions at the high CR; the HC level was reduced to below 0.9 g/mi as proposed by others to allow for production variations and deterioration when meeting a limit of 1.5 g HC/mi. All of the cars tested were equipped with the Ethyl Turbulent Flow System (TFS) which incorporates a Turbulent Flow Manifold (TFM) and a 4-barrel carburetor to ensure good distribution of the air-fuel mixture and exhaust gas recirculation among the cylinders. It is concluded from the tests that the efficiency of the aftertreatment emission control system influences the CR-fuel economy relationship at any emission level. The tests show that a one-unit increase in CR increased the Environmental Protection Agency composite fuel economy by 4.2% to 5.3% while attaining emission levels below those of the 1977 standards for the 49 states. Port liners can be used to offset the increase in HC emissions resulting from the lower exhaust temperatures that occur when CR is increased. For the two makes of cars tested, port liners in the high-compression engine limited the HC increase to 6% for a one-unit increase in CR. Using thermal reactors with the port liners, one car gave a 4.8% reduction in fuel consumption relative to that of its 1977 certification counterpart. Combining this 4.8% with the refinery energy saving associated with using tetraethyl lead in place of more severe refining, produces a total fuel savings of 8.2%.

by F. J. Marsee; R. M. Olree; W. E. Adams
Ethyl Corp., Res. Labs., Ferndale, Mich.
Rept. No. SAE-770640; 1977; 26p 8refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 186

THE USE OF INFRARED SPECTROSCOPY IN OIL IDENTIFICATION

The application of infrared spectroscopy for identifying a blended lubricating oil is discussed. Most blended oils sold consist of a base mineral oil with several added ingredients such as oxidation inhibitors, dispersants, anti-wear and anti-scoring agents, rust preventives, pour point depressants and viscosity index improvers. These ingredients are referred to in this paper as the additive package, and each additive package produces a characteristic infrared spectrum, providing a fingerprint for identification. Infrared theory, instrumentation (infrared spectrophotometer), qualitative identification, and semi-quantitative analysis are discussed. The infrared method can identify specific additive packages used in lubricating oils and in many cases, can be used to determine whether dilution with uncompounded mineral oil has occurred.

by B. Adinoff; I. Drakos; E. M. Kostello
Rockwell International
Rept. No. SAE-770641; 1977; 8p 8refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 187

USED ENGINE OIL ANALYSES--REVIEW

A review is presented of tests employed in the evaluation of used engine lubricants, together with comments on the potential significance to engine performance of the various determinations. Lubricant degradation can occur because of addi-

tive depletion or contamination (engine blowby, oxidative and thermal degradation, and improper air or oil filtration). A means for evaluating both the chemical changes and changes in concentration which may take place in additives during service is infrared spectroscopy; however, this technique is insufficient by itself. Additive depletion is difficult to evaluate by current analytical techniques; the only reliable methods are performance tests on the used oil. Engine oil contaminants, the primary source of which are engine blow-by gases which leak past the oil rings and into the oil sump, consist of both organic and inorganic acids, oxygenated organic compounds, carbon, unburned fuel, miscellaneous inorganic lead salts in the case of gasolines containing lead antiknock compounds, and silicon compounds from dirty intake air. The following tests and techniques which have been developed to measure the buildup of these various contaminants in the lubricant are individually described: insolubles content (including a method for the determination of pentane and benzene insolubles in highly dispersant lubricants which shows promise for a more complete recovery of these contaminants); acidity (TAN, Total Acid Number), alkalinity (TBN, Total Base Number); elemental analysis other than carbon, hydrogen, and oxygen (emission spectrograph, atomic absorption, X-ray absorption); chemical identification (infrared spectroscopy); viscosity determination; and dispersancy characteristics. Correlation with engine condition, however, must be established before the significance of the results obtained from these tests can be determined for a particular lubricant, engine, and type of service.

by P. A. Asseff
Lubrizol Corp.

Rept. No. SAE-770642; 1977; 14p 12refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.

Availability: SAE

HS-024 188

MORE INFORMATION ON OIL AND ENGINE FROM SLUDGE ANALYSIS

Chemical and physical methods have been utilized to characterize engine sludge deposits and their growth. The chemical method involves a slow thermal degradation and the determination of the nature and rate of evolution of degradation products (water, carbon dioxide, carbon monoxide/nitrogen oxide, methane, other lower hydrocarbons, and combustible carbon). Thermal profiles provide information on oil, fuel, additive, or engine conditions. Oil-derived and fuel-derived contributions to the sludges can be estimated by one of these profiles. Deposited and suspended sludges do not seem to differ appreciably in their nature. Addition of NO_x (nitrogen oxides) to a sump or laboratory test apparatus greatly augments the amount of sludge formed without important changes in its nature. Chemical reactions evolving water are probably an important step in the formation of sludge (baking of the deposits). The thermal profile technique has made it possible to define in a laboratory synthetic sludge test those conditions which are essential for proper simulation of the sludge obtained from a given engine. Each engine will require specific laboratory conditions for the appropriate simulation. The maxima in the differential profiles are indicative of specific degradation reactions and provide information on the nature of the sludge, especially if they are compared with those for model compounds (synthetic polymers). The growth in size and concentration of sludge particles can be conveniently measured physically with a centrifugal sedimentation method that

yields direct information about the particle-size distribution. Succinimide-type dispersants keep the sludge particles smaller (diameter about 0.1 micron). The amount of sludge suspended in the lubricating oil increases linearly with engine test time. Certain influences of additional additives become apparent.

by A. P. Zeelenberg; J. M. Wortel

Koninklijke/Shell-Laboratorium, Amsterdam, Netherlands;
Shell Res. B.V., Netherlands

Rept. No. SAE-770643; 1977; 16p 37refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.

Availability: SAE

HS-024 189

FIELD EVALUATION OF OIL ANALYSIS AS A MAINTENANCE TOOL [ENGINE CONDITION IN COMMERCIAL VEHICLE FLEETS]

A literature search and field contacts failed to produce quantitative data on the effectiveness of oil analysis when used as a routine maintenance tool in a commercial field service environment. A subsequent field test was run using line-haul, inter-city, and mining vehicle fleets, which were split into sample and control groups. There were many practical problems encountered during the field test, such as irregular sampling, provision of incomplete information, and poor follow-up on laboratory recommendations. The performance of three of the fleets was marginal compared to the guidelines outlined by the oil analysis laboratory. One of the fleets did an excellent job and followed all the guidelines. An economic analysis of the maintenance costs in the sample and control groups showed that analysis of used lubricating oil was not effective in significantly lowering the maintenance costs in any of the fleets studied. Though oil analysis was not found to be cost-effective, it was found to be most effective for detecting leaks in the air intake system and for detecting coolant and fuel in the oil. If these conditions could be detected at the engine, the major benefits of oil analysis could be obtained without the major problems.

by C. E. French; D. E. Wulffhorst

Cummins Engine Co., Inc.

Rept. No. SAE-770644; 1977; 10p 15refs

Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.

Availability: SAE

HS-024 190

PARAMETRIC STUDY OF FUEL-DROPLET FLOW IN AN IDEALIZED AUTOMOTIVE INDUCTION SYSTEM

The air, fuel vapor, and fuel droplet flow through an engine induction system is studied by a one-dimensional, two-phase, steady-flow model that includes evaporation and heat transfer through the manifold wall. The conservation equations and pertinent constitutive relations are solved numerically by the Bulirsch-Stoer integration scheme. A parametric study is carried out of initial droplet size, fuel, air-fuel ratio (A/F), wall surface roughness, initial air velocity (in terms of Mach number), percent of exhaust gas recirculation (EGR), and the heat input rate, in relation to their feasibility and effectiveness in maintaining fine droplet size and high evaporation rates. The initial droplet size is very important to engine induction

system design. Droplets of radius 15 microns or less will essentially follow the main stream and also maintain 30% or better evaporation. Droplets of radius 60 microns or more will have difficulty in following the main stream and their evaporation rate is insignificant. The mixture quality is improved significantly if the droplet radius can be maintained at less than 15 microns. The composition of gasoline fuel also influences the charge mixture quality. Dodecane droplets do not evaporate practically at all in the manifold while the same size of hexane droplets evaporate by 45% at the end of the pipe. The A/F has little effect on mixture quality, except on extremely rich mixture. The wall surface roughness also has little effect. The improvement in mixture quality due to air speed is not significant. Lower air speed will cause relatively higher evaporation because of longer droplet residence time in the manifold. The injection of hot exhaust gas into the intake manifold will result in higher droplet velocity and better evaporation. For a 20% EGR, the terminal velocity of droplet will increase by 25%, while the evaporation will increase by a factor of 60%. The best method of improving mixture quality and fuel distribution is by heating the manifold wall. Heat transfer into the air-fuel mixture equivalent to 50% of its original total energy will achieve the best overall results, since an excessive amount will result in undesirably low engine volumetric efficiency and poor performance.

by Robert S. Lo; Demetrius P. Lalas
Ford Motor Co.; Wayne State Univ.
Rept. No. SAE-770645; 1977; 19p 17refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977. Cover title: Parametric Study of Fuel-Droplet Flow in an Idealized Engine Induction System.
Availability: SAE

A TURBULENT ENTRAINMENT MODEL FOR SPARK-IGNITION ENGINE COMBUSTION

A turbulent entrainment model for spark-ignition (SI) engine combustion is presented, using the basic philosophy of the Blizard and Keck combustion model which makes use of the fundamental quantities of eddy size and turbulent intensity and which is a compromise between the global nature of the thermodynamic model and the specificity of the multi-dimensional model of combustion. The present model was developed so that the physical mechanisms governing flame propagation can be defined while still retaining simplicity. In this way the interaction of combustion and turbulence can be better understood, and possibly correlations for the ignition delay time and combustion duration can be developed. The characteristic reaction time for a large eddy (τ) is calculated using the characteristic reaction time (τ_c) for the Taylor microscale, $\lambda_{\text{micro}}/SI$, where SI is the laminar flame speed and propagation of ignition sites within a coherent turbulent structure. The reaction time (τ) is related to the flame kernel development time and shows similar trends to the ignition delay time. The combustion model is demonstrated by calculations showing the typical trend behavior of combustion duration with equivalence ratio, exhaust gas recirculation (EGR), spark timing, and engine speed. The calculations presented demonstrate that the proposed model is capable of predicting trends for ignition delay and combustion duration for conventional SI engines. In order to apply this model to a specific engine, it is necessary to determine the correct constants for the revolutions per minute dependence of the turbulent intensity and the characteristic eddy size. These constants will vary from engine to engine and evaluation of these constants will remain neces-

sary until the engine's turbulent field can be predicted. One set of constants, determined at a given operating point of the engine, should be sufficient for the entire engine operating range. The model is not capable of predicting misfire (i.e. no flame propagation), but it is capable of predicting the partial burn limit (i.e. burning into the exhaust stroke), and thus has some value in determining the practical lean limit and EGR tolerance of an engine.

by Rodney J. Tabaczynski; Colin R. Ferguson; Krisna Radhakrishnan
Ford Motor Co., Reciprocating Engines Res. Dept.;
Massachusetts Inst. of Tech., Sloan Automotive Lab.
Rept. No. SAE-770647; 1977; 19p 41refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

A SIMPLE MODEL OF TRANSIENT THERMAL FLAME QUENCHING [COMBUSTION IN SPARK IGNITION ENGINES]

An analysis of transient quenching distance at a cold wall is presented for the case of one-dimensional, oblique thermal flame propagation. A quenching Peclet number is derived and has the form of a sum of a constant and a simple function of adiabatic flame temperature, actual flame temperature, and wall temperature. Typical values of the quenching Peclet number are slightly less than the Peclet number corresponding to the pre-heating zone thickness. This implies that the values of the quenching Peclet number that have been proposed by other investigators, i.e. 30 to 60, are too high. A comparison of calculated and experimental values for quenching distances are made for a number of fuels. Calculated one-wall quenching distances are smaller than experimentally obtained two-wall quenching distances by a factor of 0.4 to 0.5. The effect of wall material on flame quenching is examined and is found to be of minor importance. The wall temperature does not increase appreciably during the quenching process and may be treated as constant.

by Nobuhiko Ishikawa; Melvyn C. Branch
University of California, Dept. of Mechanical Engineering;
University of Colorado, Dept. of Mechanical Engineering
NSF-G144379
Rept. No. SAE-770648; 1977; 11p 17refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

MANGANESE FUEL ADDITIVE (MMT) [METHYLCYCLOPENTADIENYL MANGANESE TRICARBONYL] CAN CAUSE VEHICLE PROBLEMS

To determine the effect of the fuel additive MMT (methylcyclopentadienyl manganese tricarbonyl) on exhaust emission control systems, five cars were tested for 80,000 km (50,000 mi) using a driving schedule which included 113-km/h (70-mph) steady-speed driving. (MMT is now being used in many unleaded gasolines to improve their octane quality, and use of the additive at concentrations up to 0.033 g Mn/l (0.125 g Mn/gal) is expected to increase.) In the present experimental program, the use of MMT at a concentration of 0.034 g Mn/l (0.129 g Mn/gal) caused plugging of monolithic converters

located close to the exhaust manifold, partial plugging of an underfloor bead converter, an increase of hydrocarbon emissions from the engines, and excessive spark plug deposits. However, use of MMT apparently enhanced catalytic converter oxidizing activity and did not substantially affect octane requirement increase. These preliminary data show that the use of MMT in commercial gasolines can deteriorate exhaust emission control systems and cause driveability complaints if vehicles operate under rigorous driving conditions. In addition, use of MMT may decrease vehicle fuel economy to a certain extent. More experimental work is needed before an overall assessment can be made to either justify continuing or expanding the use of MMT, or to ban it from unleaded gasolines.

by Jack D. Benson
General Motors Res. Labs., Fuels and Lubricants Dept.
Rept. No. SAE-770655; 1977; 26p 18refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 194

MMT-A FURTHER EVALUATION
[METHYLCYCLOPENTADIENYL MANGANESE
TRICARBONYL, ANTIKNOCK FUEL ADDITIVE]

Results of test programs designed to evaluate the effects of the additive MMT (methylcyclopentadienyl manganese tricarbonyl) on exhaust emissions are reported; and a discussion is presented of the effects of MMT on catalyst plugging, spark plug life, engine wear, octane number requirement, and combustion chamber deposits. (MMT is an antiknock additive for the unleaded gasoline that is now required for cars equipped with catalytic converters. Because of its effectiveness, MMT is economically attractive compared with achieving antiknock quality by refinery processing.) Results of the several road test programs, which included various types of driving schedules, have shown that, on the average, there is little or no difference in emission levels of cars operated on clear gasoline or gasoline containing 1/16 g Mn/gal as MMT. On the average, the test cars showed some increase in hydrocarbon emissions with 1/8 g Mn/gal vs. clear fuel. Experience with these test fleets indicates that the use of MMT will not cause catalyst plugging or shorten spark plug life in normal car operation. Conversion efficiency of catalysts aged on gasoline containing Mn appears to be greater than for those aged similarly on clear gasoline, based on a 22-car test of 1975 models. There does not appear to be any effect of Mn on octane requirement increase or engine wear.

by D. L. Lenane
Ethyl Corp., Res. Labs., Ferndale, Mich.
Rept. No. SAE-770656; 1977; 21p 8refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 195

CATALYST PLUGGING IN THRUWAY POLICE
VEHICLES

As a response to experiences of in-service catalyst plugging of police vehicles used by the New York State Thruway Authority, an examination was undertaken of the catalytic converters on 20 high-mileage cars from its total fleet of approximately

100 vehicles. Fourteen catalysts from 12 vehicles were found to be at least 25% physically plugged with thin deposits distributed on the front surface of the forward monolith. Analysis of these catalyst deposits by X-ray fluorescence indicated that the plugging material was composed mainly of oil-additive components (zinc, calcium, barium, phosphorus), as well as iron and lead. Except for one converter with a deposit assay of 25 wt% manganese (Mn), these deposits were in the range of 0.2 wt% to 9.2 wt% Mn. These results indicate that monolith catalysts can plug in the absence of significant levels of Mn. However, increased Mn levels in gasoline (in the form of the additive MMT (methylcyclopentadienyl manganese tricarbonyl)) result in higher levels of Mn aerosols in exhaust streams which may combine with oil-additive components to accelerate the plugging process.

by Gregory P. Wotzak; Nicholas P. Kolak; Richard E. Gibbs;
Roger J. Cheng
New York State Dept. of Environmental Conservation, Div. of Air Resources; State Univ. of New York at Albany,
Atmospheric Sciences Res. Center, Albany, N.Y.
EPA-R803520-01
Rept. No. SAE-770658; 1977; 19p 5refs
Presented at Fuels and Lubricants Meeting, Tulsa, 7-9 Jun 1977.
Availability: SAE

HS-024 196

TANDEM ANTI-LOCK SYSTEMS FOR AIR BRAKED
VEHICLES

Computer model studies and vehicle tests were conducted to investigate possible tandem antilock system configurations and factors influencing their application to different vehicle and suspension types. Tandem antilock vehicle test data are presented along with comparisons to axle-by-axle antilock control performance. The tandem antilock systems recently appearing on air-braked vehicles are cost-effective and still meet the performance requirements of Federal Motor Vehicle Safety Standard 121. However, they cannot be universally applied to vehicles without reservation. Based on the simulated and actual vehicle tests, it can be concluded that vehicles equipped with four-spring suspensions generally are adaptable to the use of two-sensor tandem systems. When applying a two-sensor system, the vehicle manufacturer must consider the possible increase in stopping distance compared to individual axle control, take into account the loss in braking efficiency caused by a high-gain wheel on the sensed axle, and must consider frame deflection under dynamic load transfer. Brake chamber pressure traces taken when testing axle control systems indicate that vehicles equipped with walking beam suspensions tend to have closely balanced axle loadings during braking and thus are more compatible with four-sensor tandem systems. Vehicle tests showed that using a two-sensor system on the walking beam vehicles was successful in preventing wheel locks only when the brakes were carefully kept in balance. Introduction of an unsensed high-gain wheel frequently resulted in high-speed wheel locks. In order to apply tandem antilock systems to variations of the basic suspension types studied, as well as to completely different suspension types existing in the heavy vehicle industry, careful attention must be paid to the interactions between the

suspension and braking characteristics before the optimum tandem antilock configuration can be selected.

by P. J. O'Keefe; M. L. Hutchins
Bendix Heavy Vehicle Systems Group
Rept. No. SAE-770662; 1977; 20p 5refs
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

HS-024 197

DESIGN OF A MOBILE SMALL WOOD YARDER [CABLE LOGGING EQUIPMENT]

A description is presented of the Skagit SY-727, a new concept in mobile yarder design being introduced to meet the demands of the small timber (classified as 18" DBH (diameter breast high) and under) logging industry. The mobile small wood yarder with its versatile yarding systems (e.g. high-lead, running skyline, gravity carriage, slack-pulling carriage) is expected to fill a growing need in the logging industry, a need stemming from the limited amount of old growth timber harvesting areas and from environmental constraints. The design innovations of the Skagit SY-727 include the combination of the yarding tower structure and the drum support frame in one integral structure; electro-hydraulic operation of the interlocked drum set; and single-personnel operation capability at the log-landing site because of the remote, ground-level, moveable control console. The powertrain utilizes an air-cooled diesel engine capable of 185 brake hp at 2300 rpm. The unit is relatively inexpensive (\$150K, less truck), economical to operate, versatile (with different yarding systems, fast setup time, and fast line speeds), and compact, mobile, and legally highway transportable. Excerpts are presented from a 9-10 Dec 1975 meeting of U.S. Forest Service region managers and representatives of logging equipment manufacturers outlining the logging environments and equipment requirements for the various regions of the country. Also appended is a logging cost study using the SY-727 (200-hp machine).

by Larry L. Dargitz, Sr.
Skagit Corp.
Rept. No. SAE-770664; 1977; 11p
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

HS-024 198

BETTER BRAKES FOR MOUNTAIN MINING TRUCKS--A PROGRESS REPORT

A new Code of Practice for the brake performance of off-highway vehicles was established in Alberta (Canada) in 1976. Vehicles loaded to gross vehicle weight must be capable of stopping with mechanical brakes five times in quick succession on a grade of 10% from a speed of 28 mph. Comparative trials (powered drag tests, loaded downhill stopping tests) have been conducted of various brake systems on rear-dump trucks (heavy mine vehicles), and some combinations capable of meeting the Code have been established. The Code is a practicable attainable minimum standard of braking performance requirements that should do much to improve the safety of personnel in loaded downhill operations. Continuing areas of interest and concern in heavy mine-haul truck braking include the effects of high dynamic loading during downhill operation

on single front tires, front-axle components, and steering mechanisms; the practice on some of the large electric-wheel trucks of driving the metal friction disc of the rear-wheel disc brakes at the wheel motor armature speed; and provision of means to reduce the front-wheel braking effect ("slippery road valve"). A number of concepts have been explored for runaway-truck emergency brakes and best results have been obtained in model tests with the "slipper flap" system, in which flat material hanging below the truck box is released in an emergency, falls under the rear wheels, and skids along the ground. This would be suitable for installation on existing older trucks.

by Graham Walker
University of Calgary, Calgary, Alta., Canada
Rept. No. SAE-770666; 1977; 12p 12refs
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

HS-024 199

TRUCK DISC BRAKES--PRACTICE MAKES PERFECT

The design parameters utilized in the development of the energy-absorbing medium (friction material and rotor surface) of a hydraulic front disc brake for heavy trucks introduced in 1975 to meet Federal Motor Vehicle Safety Standard 121 are addressed. Friction material characteristics are studied in terms of temperature, speed, and pressure sensitivity. Truck geometry is examined along with friction materials to evaluate the combined effects on stopping distances, resulting in a quick reference method for predicting the 60 mph stopping distance for any straight truck configuration. Rotor thermal stress and interface durability characteristics are also discussed. Tests show that the FMVSS 121 stopping distance of 245 ft (74.7 m) can be attained on most heavy highway vehicles with a disc braked front axle. Limiting factors are relationship of wheel base to vertical center of gravity, road spring stiffness, suspension damping characteristics, rear drum brake stability and effectiveness, and tire to road adhesion. Stopping distances can be predicted within plus or minus 5% for most popular truck configurations employing front disc brakes. However, the disc brake friction material must be temperature stable, with minimal sensitivity to speed and pressure variations. The horsepower absorption characteristics of the friction material must be evaluated. High friction rated materials often perform very adequately on dynamometer compliance, but fail to stop the truck in compliance distance. Pearlitic iron rotors of ventilated design offer flexibility in choice of brake lining materials for interface compatibility, in terms of friction stability and durability. High energy thermal damage can be prevented by the use of high carbon equivalent iron, and/or alloying. Friction materials with high metallic content and/or rapid heat conducting capability, alleviate the heat check phenomena. Truck disc brake lining technology has advanced to the stage where a life of one and a half times that of a drum brake with comparable compliance and duty cycle levels can be anticipated.

by P. Raves
Kelsey-Hayes Co.
Rept. No. SAE-770667; 1977; 20p 4refs
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

April 30, 1979

HS-024 203

HS-024 200

THE GIRLING 'TWINSTOP' BRAKE [HEAVY TRUCKS]

The development is described of a two-leading shoe air/spring-operated wedge brake for heavy commercial vehicles of up to 13 tons static axle weight, the Girling "Twinstop" brake. Since its introduction in 1975 the "Twinstop" brake has made a significant impact on the European heavy truck brake field. The dual-wedge design of the brake gives a more uniform shoe-to-drum loading pattern than the conventional "S" cam. An auto-adjustment mechanism is incorporated which is fully enclosed and functions on the same proven principle as in automobile rear disc brakes. Overall brake assembly weight is reduced by the use of direct-mounted actuators. The brake has been adopted by major vehicle manufacturers in view of higher permissible axle weights, improved half systems, and handbrake requirements in Europe.

by W. R. Newton; M. J. England
Girling Ltd. (U.K.)

Rept. No. SAE-770668; 1977; 12p 3refs

Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.

Availability: SAE

tion distance and reaction time, the three criteria used to determine the most suitable symbols were visibility when blurred, visibility at low contrast, and identification in relation to acceptability. It was found that the rank order of performance with different symbols differs with the criterion used; that the blur variable, which is a relatively new visibility criterion, proved successful in differentiating among symbols; and that visibility can be better for unconventional symbols than for the more conventional forms. Any advantage offered by completely new symbols may be offset by lack of understanding of their meaning. Some practical artifacts (e.g. effects of cowls and louvers, non-uniformity of symbol luminance, mis-aiming of the signal) were neglected in the study, but these factors assume significance in their differential effects on visibility only for the more unconventional symbol shapes.

by G. Smith; Robyn Weir

Publ: Ergonomics v21 n4 p247-52 (Apr 1978)

1978; 7refs

Includes French and German summaries.

Availability: See publication

HS-024 203

A NEW GAS TURBINE FOR TRUCKS

A new gas turbine engine for trucks, the GT601, is being developed by Industrial Turbines International (ITI), a consortium of Mack Trucks, Inc. and Garrett Corp., American firms, and one German company, Klockner-Humboldt-Deutz A.G. All have extensive backgrounds in worldwide truck engine manufacturing. The GT601 is an all-metric design that ITI refers to as a recuperated cycle free power turbine engine in the 300 kW to 560 kW (402 hp to 750 hp) shaft power class. The engine weighs 988 kg (2178 lb) and measures 1492-mm (58 3/4-in) long, 1038-mm (41-in) wide, and 1119-mm (44-in) high. All engine accessories are gear driven, and include the starter, lubrication pumps, fuel pump, governor, and an air pump which is used for starting only. Likewise, all vehicle accessories (brake air compressor, air-conditioning compressor, alternator, and power steering pump) are gear driven. Aeromechanically, the engine consists of a gas compressor section, a recuperator section, a combustor section, and a power turbine section. An electronic computer oversees engine operation for minimum fuel consumption. At its commercial rating of 410 kW (550 hp), the GT601 should have an overhaul life of 10,000 hr in over-the-road truck use. The lack of belt-drive accessories and water-cooling system contribute to low maintenance, and there is easy access to engine components. The variable stator, free power turbine design makes transmission requirements relatively simple. Though laboratory test-cell and in-vehicle evaluations of the GT601 have just begun, results to date look very good. In combustion tests, the GT601 produced 3.7 g/bhp-hr nitrogen oxides and hydrocarbon; the carbon monoxide content of the exhaust was 0.076 g/bhp-hr. Installed in an 80,000-lb tractor-trailer combination, the engine accelerated the loaded rig from a dead stop to road speed using only top gear of a 5-speed manual transmission. Initial fuel consumption results are in the area of 238 g/kW-hr (0.39 lb/hp-hr) which is within the diesel engine range. If all goes well, production of the GT601 could begin as early as 1981.

by Dave Ritchie

Publ: Owner Operator v8 n5 p41-5 (Sep-Oct 1978)

1978

Availability: See publication

HS-024 201

A FRONT WHEEL DRIVE 23,000 POUND AXLE

The combination of individual parts that have been integrated into a unique steering-driving axle, the Kelsey-Hayes Model SDA-23 Front Wheel Drive Axle, the only heavy-duty truck axle in its capacity range to be equipped with disc brakes, is described. This axle combines for the first time high load capacity, high torque capacity, and high braking capacity. Compact steering-driving ends combine with an inclined king pin to give a small scrub radius. The full turn capability can generally be realized even with the wide tires most often used. The single cardan joint and heavy shafts provide an unusually durable drivetrain. The disc brakes provide stopping capability meeting the strictest requirements. Axle housing construction allows tailoring of the axle to the vehicle. The axle was made from readily available parts of known capacity and life expectancy; it includes readily available differential carriers, universal joints, wheel bearings and brakes. The axle was designed for on-off highway service, is outstandingly capable at low speeds, and is stable at high speeds.

by J. Stanley L. Thomas

Kelsey-Hayes Co.

Rept. No. SAE-770669; 1977; 10p 3refs

Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.

Availability: SAE

HS-024 202

LABORATORY VISIBILITY STUDIES OF DIRECTIONAL SYMBOLS USED FOR TRAFFIC CONTROL SIGNALS

As part of a program developed in response to a request from the Standards Assoc. of Australia for a traffic control signal directional arrow suitable as a national standard, laboratory visibility studies were made of eight directional symbols. Instead of the more conventional field-type criteria of recogni-

TRANSPORTATION POLICY FOR A CHANGING AMERICA. A STATEMENT BY SECRETARY OF TRANSPORTATION BROCK ADAMS, FEBRUARY 6, 1978

The broad directions and goals to be pursued by the Dept. of Transportation (DOT) in developing Federal transportation policies and programs for the future are addressed. Priority areas which will have to be accommodated to a far greater degree than in the past include energy conservation and production, environmental protection and enhancement, safety, quality of life, and improved resource allocation, both human and material. Recent DOT decisions guided by these imperatives and DOT actions directed to the traditional transportation concerns of economic development, national security, and more efficient and responsive public and private sectors are outlined. Major new directions for national transportation policy include Federal investment and financial policy towards the interstate transportation system (highways, railways, intercity bus, waterways, airways); Federal investment and subsidy policy towards urban and rural local transportation systems; economic regulation; international (national security and foreign relations, international air commerce, maritime); safety-energy-environment-jobs; and management of Federal transportation functions. Acceptance and implementation of these new directions would result in a fresh and effective approach to Federal decisionmaking through allocation of Federal financial assistance to transportation; protection and enhancement of existing transportation facilities through proper maintenance and incorporation of new research developments; an Interstate Highway System with all essential links completed and provision made for future maintenance; Federal grant programs for urban and rural transportation that stress flexibility necessary for state and local decisionmakers; major rail transit systems where needed; a completed system of major airports with provision for continuous improvement in aviation safety; a steamlined private-sector rail system providing increasingly safe, efficient, and energy-saving freight transportation; a rail passenger system providing effective service on a nationwide selected set of routes at a reasonable subsidy level; a private sector bus system providing extensive intercity and regional services; an inland waterway system in good condition, with users paying a substantial share of Federal costs; and healthy transportation companies operating in a regulatory environment offering consumer protection and fair competition.

by Brock Adams
Department of Transportation, Office of the Secretary,
Washington, D.C. 20590
1978; 26p
Availability: Corporate author

desulfurization of the fuel, or stack-gas treatment of the combustion products; shale oil; and coal and coal-derived synthetic fuels. The latter category includes solvent-refined coal, low-Btu and medium-Btu gas, methanol from coal as well as "true" liquid fuel from coal, and the direct utilization of coal either with stack-gas scrubbing and a conventional boiler, or in a fluidized-bed boiler. Stack-gas scrubbing has been demonstrated successfully. Power generation from coal, even with stack-gas scrubbers, will be the most economical way to generate electricity in the future. Conversion of coal to a liquid or a gas will result in losses which will always make it more expensive than burning coal directly. Such fuels will have a role to play in the future for those types of electric power generation which are only used on an intermittent basis to meet peak electric demand requirements. Utilization of a domestic resource, coal, for future generation is preferable to dependence on imported oil.

by Alexander Weir, Jr.
Southern California Edison Co.
Rept. No. SAE-770672; 1977; 7p
Presented at International West Coast Meeting, Vancouver, 8-11 Aug 1977.
Availability: SAE

MODELING THE RESPONSE OF THE DOMESTIC AUTOMOBILE INDUSTRY TO MANDATES FOR INCREASED FUEL ECONOMY: AN INDUSTRY MODEL

An analysis is made of the full, long-term response of the U.S. automobile industry to mandates for increased new car fuel economy as legislated in the Energy Policy and Conservation Act of 1975 by utilizing a rather simple industry model. The approach assumes that the domestic auto industry acts as if it were a single entity maximizing the joint profits of its members. The monopoly assumption, while not doing full justice to the price leadership form of oligopoly actually existing in the domestic market, provides insights that are obscured in most other studies by the assumption of purely competitive markets. Three sizes of cars are modeled as representative of industry output, and the industry is assumed to select the cars' prices and fuel economies to maximize long-run profits. This model is initially fitted to 1976 market information when there were no mandates in effect. The model's parameters are used to estimate the equilibrium changes in prices, costs, sales, profits, individual and aggregate fuel economies, and governmental revenues when various levels of fuel economy mandates are imposed for 1975. This analysis of fuel economy taxation has shown that the response of the auto industry is composed of two distinct actions: technical actions to improve fuel economy of all cars produced; and pricing actions, designed to promote the sale of small fuel-efficient cars and retard that of large inefficient ones. With the demand and cost parameters used, very little incentive is required to induce industry to implement all of the available technology for increasing fuel economy. The current industry profit and demand structures are weighted so heavily in favor of larger cars that large incentives would be required to cause any significant sales shift from large to small cars. With respect to implications for public policy, the fuel economy mandate should be set close to the estimated limits of technology and a low fuel economy tax rate should be chosen. The mandate should be set high since the industry has no incentive to surpass whatever level is set; and the fuel economy tax rate should be low to avoid impact-

ALTERNATE FUELS FOR POWER GENERATION [FUTURE PRODUCTION OF ELECTRICITY IN THE U.S.]

This discussion focuses on the potential for generation of electricity in the U.S. with various fossil fuels in an environmentally-acceptable manner, recognizing that hydroelectric and nuclear power are significant sources, and that other technologies such as solar and geothermal may play a role. Fuels and fuel processes considered include Alaskan oil with either

April 30, 1979

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ing heavily on industry profits if the technology or demand predictions are wrong and the mandated level of fuel economy cannot be achieved.

by J. P. Stucker; B. K. Burright; W. E. Mooz
Rand Corp., 1700 Main St., Santa Monica, Calif. 90406
Rept. No. P-5858; 1977; 41p 15refs
Rand Paper Series. Prepared for presentation at 1977
Conference of the Western Economic Assoc., Anaheim, Calif.,
20-23 Jun 1977. Based on research sponsored by National
Science Foundation.
Availability: Corporate author

HS-024 207

WHOLE BODY RESPONSE RESEARCH PROGRAM. FINAL REPORT [HUMAN SURROGATES IN AUTOMOTIVE IMPACT ENVIRONMENT]

The research program was designed to generate data on the kinematic response of human surrogates, restrained by a three-point belt system, when subjected to a realistic automotive impact. Ultimately the data are to be used in identifying similarities and differences in kinematic response of the various types of surrogates, and in pointing out areas that need improvement in anthropomorphic test devices (ATD's), and in the development of mathematical models. The immediate objectives of the program were to develop and employ the techniques necessary for obtaining the desired whole-body kinematic responses, conduct sled tests with fully-instrumented and properly-selected subjects, and analyze the resulting data. The program used a test configuration consisting of an idealized hard-seat representation of a car seat with a three-point harness restraint system. Three different severity levels of crash test conditions were used. The human surrogates tested were 15 male cadavers, a Hybrid II (Part 572) Anthropomorphic Test Device, and a Hybrid III ATD recently developed by General Motors. Mathematical simulations of the response and kinematics of a 50th percentile male occupant were performed at the three levels of crash severity, using the Motor Vehicle Manufacturers Assoc. (MVMA) Two-Dimensional Crash Victim Simulator. The data produced represent one of the most comprehensive and extensive documentations of whole-body response to date. Procedures for handling and preparing cadavers for a sled test were developed, as well as instrumentation mounting techniques to allow effective and reliable monitoring of various transducer signals. Several new analytical techniques were designed including a general-purpose digital filtering technique, a three-dimensional motion analysis program to measure the motion of the head or any other rigid body, a 3-D X-ray technique to locate implanted instrumentation, and an improved Head Injury Criterion (HIC) computation algorithm. The computer simulations demonstrated that a 2-D whole-body motion model can be effective for simulating important crash events which include large 3-D motions, that anthropometric and biomechanical data developed for the head and neck of the MVMA 2-D model are reasonable, that a crash victim simulator is further validated as a research tool, and that research using both computer simulations and instrumented tests might be particularly useful. Repeated runs on the same cadaver did not invalidate results of the second run, and embalming did not significantly affect the response measures. Head-neck response is consistent with the physical construction of the various necks, and chest responses (measured

by spinal accelerometers) and pelvic responses of Hybrids II and III were in general agreement with those of the cadavers.

by Nabih M. Alem; John W. Melvin; Bruce M. Bowman;
Joseph B. Benson
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.
and Baxter Rd., Ann Arbor, Mich. 48109
GMRL-77-375-KB1
Rept. No. UM-HSRI-77-39-1; 1978; 118p 17refs
Rept. for 1 Jul 1973-31 Aug 1977. App. A: Methodology is HS-
024 208; App. B: Raw Data is HS-024 209; App. C: Processed
Data is HS-024 210.
Availability: Corporate author; General Motors Res. Labs., 12
Mile and Mound Roads, Warren, Mich. 48042

HS-024 208

WHOLE BODY RESPONSE RESEARCH PROGRAM. FINAL REPORT. APPENDIX A: METHODOLOGY [HUMAN SURROGATES IN AUTOMOTIVE IMPACT ENVIRONMENT]

The analytical and experimental methods developed for a research program to generate data on the kinematic response of human surrogates, restrained by a three-point belt system, when subjected to a realistic automotive impact, are described. The methods were developed for a whole-body response (WBR) research program but may be applied in a wide range of situations. Though it is oriented to tests using human cadavers, the protocol of conducting a WBR test applies as well to the anthropomorphic test devices (ATD's--dummies) used. The sequence of tasks includes the design of the experiment, subject and sled preparation, conducting the test, and finally, performing a post-test examination. The signal processing package is comprised of two separate phases, the analog-to-digital conversion phase, and the digital filtering phase. A three-dimensional X-ray technique developed to obtain the orthogonal transformation matrix between the instrumentation and anatomical reference frames is described. It was developed for the Hwy. Safety Res. Inst. measurement method of 3-D head motion but may be applied to any general instrumentation hardware. The kinematic equations of motion of a rigid body are developed, solved, and validated with actual and hypothetical motions. HIC (Head Injury Criterion) properties are examined and used to outline a fast and efficient algorithm for computing the HIC of a given resultant acceleration pulse.

by N. M. Alem; J. B. Benson; G. L. Holstein; J. W. Melvin
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.
and Baxter Rd., Ann Arbor, Mich. 48109
GMRL-77-375-KB1
Rept. No. UM-HSRI-77-39-2; 1978; 110p 12refs
Rept. for 1 Jul 1973-31 Aug 1977. Final Rept. is HS-024 207;
App. B: Raw Data is HS-024 209; App. C: Processed Data is
HS-024 210.
Availability: Corporate author; General Motors Res. Labs., 12
Mile and Mound Roads, Warren, Mich. 48042

HS-024 209

WHOLE BODY RESPONSE RESEARCH PROGRAM. FINAL REPORT. APPENDIX B: RAW DATA [HUMAN SURROGATES IN AUTOMOTIVE IMPACT ENVIRONMENT]

Complete test-by-test documentation is presented of all raw data generated in 1975 and 1976 as part of a research program

to obtain information on the kinematic response of human surrogates, restrained by a three-point belt system, when subjected to a realistic automotive impact. Raw data generated in the first two years of the program were presented in UM-HSRI-76-3. Some of the early data which were not reported previously are included now. The appendix is organized in 11 data packages. Each of the first nine packages is devoted to one cadaver; the 10th package is devoted to Part 572 ATD (anthropomorphic test device) test series; the last package contains the previously unreported data. Each cadaver raw data package is divided into two or more groups of data sheets: the first group pertains to the description of the cadaver and the instrumentation, as well as the thorax autopsy, while the remaining group(s) pertain to each test conducted on that cadaver. Each contains a detailed set-up diagram and photographs, the filtered signals, and a graphcheck of the test.

by N. M. Alem; J. B. Benson; T. A. Tann
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.
and Baxter Rd., Ann Arbor, Mich. 48109
GMRL-77-375-KB1
Rept. No. UM-HSRI-77-39-3; 1978; 307p
Rept. for 1 Jul 1973-31 Aug 1977. Final Rept. is HS-024 207;
App. A: Methodology is HS-024 208; App. C: Processed Data
is HS-024 210.
Availability: Corporate author; General Motors Res. Labs., 12
Mile and Mound Roads, Warren, Mich. 48042

HS-024 210

**WHOLE BODY RESPONSE RESEARCH PROGRAM.
FINAL REPORT. APPENDIX C: PROCESSED DATA
[HUMAN SURROGATES IN AUTOMOTIVE IMPACT
ENVIRONMENT]**

Tabular and graphical details are presented of all recorded and computed variables from a research program to generate data on the kinematic response of human surrogates, restrained by a three-point belt system, when subjected to a realistic automotive impact. Graphical output of measured and computed accelerations, velocities, and displacements, as well as forces, is provided. For each sled test conducted, a summary sheet is included which gives the peaks of all the variables and the times at which they occurred. The results are arranged by tests and grouped according to data obtained for cadavers and those obtained for dummies. There were three series of dummy runs, and each is considered separately, the DM3X series in which a Part 572 anthropomorphic test device (ATD) was used with standard instrumentation, the DM9X series in which the 9-accelerometer package was added to the Part 572 ATD, and the DUM series in which the standard instrumentation was combined with external transducers similar to those used in cadaver runs. Since most of the instrumentation problems had been ironed out for the last DUM series, the resulting data should be more reliable than the data obtained from the first two series.

by N. M. Alem
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.
and Baxter Rd., Ann Arbor, Mich. 48109
GMRL-77-375-KB1
Rept. No. UM-HSRI-77-39-4; 1978; 346p
Rept. for 1 Jul 1973-31 Aug 1977. Final Rept. is HS-024 207;
App. A: Methodology is HS-024 208; App. B: Raw Data is HS-
024 209.
Availability: Corporate author; General Motors Res. Labs., 12
Mile and Mound Roads, Warren, Mich. 48042

HS-024 212

ROAD ACCIDENT COSTS [NEW ZEALAND]

This study addresses itself to the broad task of improving decisionmaking skills with respect to road safety, in order to assist New Zealand authorities in their attempts to minimize the loss, both human and material, which results from road accidents, given the constraints of a limited budget. The study reviews the relevant literature, describes and evaluates the methods of estimating road accident costs used in previous studies, assessing their conceptual legitimacy and practical application; examines the sources of relevant data available in New Zealand; estimates, very generally, the magnitude of road accident costs in New Zealand, with particular emphasis on the relevant magnitudes of the various factors contributing to total road accident costs (property damage, loss of productive output, medical and hospital costs, incidental costs such as emergency services and legal costs, and intangible costs such as pain and suffering); and proposes the direction of future research. If knowledge of road accident costs is to be used to determine road safety priorities, the factors which influence the magnitude of costs must be identified and the sensitivity of costs to changes in those factors must be determined. Assuming that stable identifiable relationships exist, categories of accidents which display some internal homogeneity with regard to cost should be defined. Ideally, each category should display only a relatively narrow range of costs and the average or modal cost within each should differ significantly from those of other categories. In addition, the accidents included in each category should possess some functional relevance, e.g. be responsive to the same preventive measures. The possibility of developing such categorizations in New Zealand looks promising, especially since the Ministry of Transport already classifies accidents into 15 types according to vehicle movement at the time of the collision. The direction in which further New Zealand research into road accident costs should proceed is uncertain. To be useful, road accident cost data must be reliable, readily applicable to a wide range of traffic safety problems, and uncomplicated in its presentation. Generally, the problems encountered in quantifying road accident costs are related primarily to the degree of accuracy required.

by M. A. Sherwin
University of Waikato, New Zealand
Publ: HS-024 300 (RRU-Bull-38), "The Cost of Road
Accidents," Wellington, New Zealand, 1978 p5-31
1978; 26p 15refs
Presented at a workshop held in Wellington, New Zealand, 1
Mar 1977. Summary of a report "The Economics of Road
Accidents," Mar 1976.
Availability: In HS-024 300

HS-024 213

**ASPECTS OF ACCIDENT COST MEASUREMENT
FOR ROAD SAFETY POLICY [NEW ZEALAND]**

The procedures necessary for obtaining accident cost estimates which would be of direct value in improving New Zealand road authorities' decisions are discussed. This requires knowledge of the relationship between accident type and cost. The purposes of accident cost measurement and the way in which obtainable measurements relate to those purposes must be addressed in order to place such measurements in context. Since the hazard on specific sections of road can only be measured at low relative accuracies, it is impossible to identify situations which are, in practice, sufficiently more hazardous

than others to justify special outlays for safety reasons. The solution seems to be to try to formulate road safety policies for which on average the benefits exceed the safety costs. This involves an attempt to identify specific accident types which are related either to road features (width, guard railing or its absence, advisory signs, curvature in relation to other parts of roadway, closeness of poles to road edge, marking of drains) or, in urban areas, to the traffic control regimen. By identifying and studying such accidents, and using the relevant cost data by the broader accident type groups, it is possible to identify areas where new safety standards for construction work, and policies to extend the safety investment in the roadway would be justified. The 16% of injury accidents, and 24% of fatalities which occur while cornering are an indication of one area where road geometry, traffic engineering and driver behavior all contribute. There are two approaches to accident cost measurement which could be adopted, a very comprehensive survey or a sequence of studies over a period of years; the latter approach is likely to be more cost-effective, especially if there is continuity of personnel. After property damage, injury losses, and fatalities are accounted for, diminishing returns will limit the further gains possible from improved accuracy in cost measurement. These three features can be examined relatively independently, provided they are carefully linked to the accident characteristics used by the Ministry of Transport.

by L. F. Jackson

Victoria Univ., Wellington, New Zealand

Publ: HS-024 300 (RRU-Bull-38), "The Cost of Road Accidents," Wellington, New Zealand, 1978 p33-68
1978; 34p 18refs

Presented at a workshop held in Wellington, New Zealand, 1 Mar 1977. Summary of a report "Accident Patterns, Cost Measurement and Safety Policy," Feb 1977.

Availability: In HS-024 300

HS-024 214

MOPEDS AND TRAFFIC SAFETY. A DESCRIPTION OF THE GROUP-MOPED OWNERS AND THE HAZARDS OF MOPEDS (DE BROMFIETSER EN DE VERKEERSVEILIGHEID. EEN BESCHRIJVING VAN DE GROEP BROMFIETSBEZITTERS EN VAN DE ONVEILIGHEID VAN BROMFIETSERS)

An analysis is presented of data collected in Sep 1970 by the Dutch Statistics Inst. on moped owners in the Netherlands. For comparison purposes, some data collected in two previous surveys (Apr 1963, May-Jun 1968) are included. The data analyzed were collected in 2001 interviews with moped owners throughout the Netherlands. The following categories of information were obtained: sex, age, social status, profession, income level of household, regional area of residence, degree of urbanization of residence, driving experience, annual mileage covered by moped and the number of times the individual was involved as a driver in a moped accident, make of moped, possession of a crash helmet, use of helmet from viewpoint of traffic safety, and objections to obligatory use of helmets (the questions related to helmets to be treated in a separate report). It is estimated that the total number of mopeds in the Netherlands in 1970 was 1,900,000, the majority belonging to men and young people but the number among women on the increase. The annual number of moped riders (and passengers) killed and the number injured have been increasing slowly for about ten years, but their numbers in the overall traffic accident victim statistics have decreased in recent years. In 1970,

540 moped drivers and passengers were killed, and 24,686 were injured. In recent years, the higher accident rate (number of accidents per km ridden) for young drivers vs. older ones has become even more apparent. On the other hand, the death rate has been higher for older moped drivers vs. younger ones, a trend which has also become more apparent in recent years. Although women in general have a higher accident rate than men, the death rate for men is higher. In recent years, an increase in the accident rate of moped riders has occurred particularly in the western part of the country and in the major cities. The differences in type and severity between accidents involving a moped and those involving a motorcycle/motorscooter are minor. More than half of the injuries sustained by moped riders who are admitted to hospital consist of head/neck injuries.

by A. A. Vis; P. S. Noordzij; A. Blokpoel; G. C. Ederveen
Stichting Wetenschappelijk Onderzoek Verkeersveiligheid (SWOV), Netherlands
1977; 87p 2refs

Translated from Dutch (original text (partial) 36p; translation 51p).

Availability: Reference copy only

HS-024 215

ACTION ON ALCOHOL AND ROAD ACCIDENTS

Road accidents now account for more than 40% of all deaths for males between the ages of 15 and 24 in England and Wales; it is questioned how long the British public health authorities can continue to ignore the problem. Awareness by many countries that one of the main reasons for failure to control drinking drivers is the extremely small risk of being caught while driving above the legal limit, has led them to consider the introduction of "random tests" allowing a police officer to subject a driver to a screening breath test entirely at the officer's discretion. However, the introduction of random tests would not be cost-effective, since the main contributor to alcohol-related crashes is the atypical driver who drinks very excessively, not the average drinking driver. The case for random tests should rest on distribution studies of alcohol in the driver population, and no such studies have been carried out in Britain. Meanwhile, the best hope lies in concentrating screening breath tests at those places where drivers are most likely to be found with above the legal limit. The poor quality of data on road accident morbidity is another problem. There is clearly a need (not so far recognized in Britain) for information provided in confidence by hospitals about blood alcohol concentrations (BAC's) in traffic accident victims. With respect to sentencing of drinking-driver offenders, there has been a failure in Britain to discriminate among different types of drinking drivers. High-risk offenders (200 mg/100 ml BAC) should be required to convince the courts that their driving no longer represents a danger to others. The increase in the numbers of drivers who abuse alcohol and its consequences should stimulate the medical profession to treat alcoholism more seriously. Further research needs to be done in Britain before really effective measures can be introduced to treat the drinking-driving problem. High on the list should come roadside surveys of the BAC distribution in the driving population, combined with surveys of the attitudes of drivers towards drinking and driving. More needs to be known about convicted drivers so that the courts can adopt a more selective policy in sentencing. Finally, the government should devise a program similar to that of the Road Safety Act of 1967, when the introduction of the 80 mg/100 ml BAC legal limit and a screening breath test were combined with a concentrated campaign of

HS-024 216

HEAD PROTECTION FOR CYCLISTS. MEDICAL ASPECTS

All aspects of helmet usage in which questions of head, neck, and shoulder injuries might be involved, together with questions of helmets in relation to vision and hearing, the effects of accessories, and psychological effects, were addressed at an American Medical Assoc.-sponsored Conference on Medical Aspects of Head Protection for Cyclists, held in Washington, D.C. on 14 Apr 1977. Direct medical aspects are discussed under the headings of cervical spine, clavicle, chin strap and chin cup, peripheral vision, helmet weight, and auditory aspects. Related medical aspects include alcohol involvement, speed, effects of accessories, tinted face shields/visors, thermal aspects, sense of overconfidence, and improper helmet removal. It is recommended that every individual who drives or rides a motorcycle wear a properly fitted approved helmet; full-facial coverage should be worn because of its extra protection; mopedists should also wear helmets, since they are subjected to the same type of trauma hazards as motorcyclists; bicyclists should be advised to wear helmets, because they are subjected to the same forces as a motorcyclist if involved in a crash with a motor vehicle; and the medical and public health community should actively involve itself in promoting safety helmet use.

Publ: Kansas Medical Society Journal v78 n12 p529-32 (Dec 1977)
1977
Availability: See publication

HS-024 217

REACHING PROBLEM-DRINKING BLACKS: THE UNHERALDED POTENTIAL OF THE DRINKING DRIVER PROGRAMS

A review of available literature on alcohol use and abuse among Black Americans reveals that the quantity of research has not been proportional to the size of the black population in the U.S. nor to the purported frequency and severity of problem drinking among blacks. Most of these studies have only come within the last ten years and have usually generated as many questions as answers. In an effort to respond to the issue of underutilization of treatment facilities by blacks and to ensure the provision of alcoholism treatment services to the black community, the National Inst. on Alcohol Abuse and Alcoholism (NIAAA) prepared its Interim Guidelines for the establishment of Black Alcoholism Projects. A comparative analysis is provided of selected background, treatment process, and treatment outcome variables of a group of white and black males referred to one drinking-driver program, the Services for Traffic Safety (STS) Proj., a 3-year demonstration project funded by NIAAA and operated with the Boston Alcohol Safety Action Proj. (ASAP). The ASAP/STS program utilized the police, the courts, and the therapeutic community to form a complete early intervention system geared specifically to the problem-drinking driver. Statistically significant

divorced, had lower education levels (but no difference in income level or employment status), and had significantly higher blood alcohol concentration (BAC) at time of arrest. The high BAC levels of whites and blacks indicates the development of high tolerance to alcohol and the probable presence of a drinking problem requiring treatment. The lack of difference between groups on the remaining variables (previous drunkenness records, drinking driver arrests, other criminal offenses, and drinking diagnosis) supports the conclusion that the characteristics of the two groups were essentially similar. Both groups were involved in the same treatment, for the same period of time, and exhibited the same frequency of attendance. That fewer blacks than whites were referred to Alcoholics Anonymous (AA) probably reflects the lack of black AA meetings in the Boston area. Treatment impact on the drinking and driving behavior and attitudes was equally distributed across the groups and it was positive in nature. Findings provide little support for the position that alcoholism among blacks is a distinctive problem. Findings also support the contention that the potential of court-enforced treatment is significant and should not be overlooked in any plan aimed at providing treatment services to the black community.

by Milton Argeriou

Publ: International Journal of the Addictions v13 n3 p443-59 (Apr 1978)
1978; 33refs
Availability: See publication

HS-024 218

THE DRIVING RECORDS OF MULTIPROBLEM FAMILIES

The driving behavior of members of 16 Tasmanian (Australia) multiproblem families and their descendants were investigated. For 764 persons (546 over the age of 12 years) 1173 major traffic convictions, 2511 criminal offenses, and their social pathology were recorded. Traffic offenses were studied as one of the indicators of the way in which families with a multiplicity of problems use their motor vehicles, illustrating for the first time another aspect of their behavior in comparison with that of the community in general. Traffic convictions were analyzed under the headings of car stealing, moving offenses, non-moving offenses, and accidents. Car stealing, the ratio of non-moving to moving offenses, and accidents are considerably higher than for the general population. A discussion is presented of the relationship between driving pathology and social pathology; the findings are related to the concept of "social handicap." In general, those with many criminal offenses seem to have many traffic convictions. The general lifestyle of the multiproblem families is also expressed in their driving habits. They have few or no personal possessions; they spend more time outside the home and more time inside their cars than others. Although youths will fiercely defend their own cars and meager possessions, they seem unable to relate this to others, from whom they willingly steal. Children from the fringe families often suffer isolation at school, meet prejudices, and are even ostracized within their own neighborhoods. They assert themselves to counteract their inferiority, and later use the car as a medium of aggression. These children have many fights and accidents, and display much violence in daily life. This is reflected in their criminal behavior, especially under the influence of alcohol; their driving habits are

pear to be closely comparable. The early age of leaving home, their considerable mobility, sexual activities, casual employment, and many changes of address, are all aided by the use of a car. These family members are likely to be involved in certain car violations, and, as a corollary, youngsters with a high record of accidents, car stealing, and aggressive behavior in the car are more likely to have a disturbed family background. The families are well known to the police, are frequently in court, and often in prison. Court appearances and prison sentences have less stigma for these families than for others. These families cost the community much; present methods of dealing with them are helping only a small proportion.

by Rona Hagger; E. Cunningham Dax
 Publ: Social Science and Medicine v11 n2 p121-7 (Jan 1977)
 1977; 35refs
 Sponsored by Australian Criminology Res. Council.
 Availability: See publication

HS-024 219

DETERRENCE OF DRINKING-DRIVING: PRIORITIES IN PUBLIC POLICY

Drinking-driving is a sub-category of two other major sets of problems: damage associated with collision and with alcohol consumption. Within each, drinking-driving rates attention because of its high prevalence; damage is costly in human and financial terms, and much of the damage is perceived as unnecessary and preventable. Among the many suggestions for dealing with the problem are increased fines, mandatory incarceration, compulsory treatment or education programs, stepped-up police enforcement, and development of devices to unlink drinking and driving. The highest priority should be placed on measures apt to be most effective. Prevention of drinking-driving is a matter of deterrence: individual (or specific) or general. Individual deterrence is aimed at the norm violator to prevent repetition. General deterrence involves punishing a violator so that others are influenced. Punishment will be a deterrent if it is swift, uniform, certain and severe. Per se laws which make it an offense to drive a motor vehicle if one's blood alcohol concentration (BAC) is above an established level have been introduced in many jurisdictions. These laws do not make it easier to identify a drinking driver, but to convict one. The likelihood of apprehension did not increase with these laws. Drinking drivers continued to come to the attention of the police as a result of accidents or law violations such as running a stop light. Objective certainty of punishment refers to the real likelihood of being apprehended or punished. The subjective is the perceived likelihood of the certainty of punishment. Attention given by the media to new legislation on drinking drivers appears to increase the subjective likelihood when there was no appreciable change in the objective likelihood. In time, drivers may align their subjective perceptions with the objective reality and return to previous drinking-driving behavior. In order to produce a long-lasting deterrent effect, priority must be given to increasing the certainty of apprehension. Drivers would see and hear about other drivers being stopped, charged and convicted. Catchment systems must be introduced so that police can identify drinking drivers, rather than having such drivers bring themselves to the attention of the police. The single most useful piece of legislation would be to permit random stopping of cars for breath testing. Police must be provided with necessary training and equipment. No other measure should be instituted until this has been tried. Driver inconvenience may be found

to be socially acceptable when measured against potential social benefits. The present system of fines and license suspensions should be continued. Suggestions for lowering the legal limit of BAC could only be effective if random checks of drivers are being carried out. The drinking-driving problem can be reduced without significant social disruption, great individual inconvenience or costly programs.

by Paul C. Whitehead
 Publ: Canadian Journal of Public Health v68 p447-51 (Nov-Dec 1977)
 1977; 26refs
 Presented at 12th Annual Conference of Canadian Foundation on Alcohol and Drug Dependencies, Winnipeg, Jul 1977.
 Availability: See publication

HS-024 220

BIORHYTHMS AND HIGHWAY CRASHES. ARE THEY RELATED?

Biorhythm, a theory that purports to identify periods of increased individual susceptibility to accident or misfortune on the basis of recurring biological cycles, is currently enjoying worldwide popularity. In view of the implications of such a theory for both public health and safety, a study was undertaken as an empirical test of its validity. Using data from 205 carefully-investigated highway crashes (135 fatal, 70 non-fatal) in which the drivers were clearly at fault, specific points in drivers' biorhythm cycles at which the accidents occurred were computed. The observed frequencies of accidents occurring during so-called critical and minus periods were then compared with the frequencies to be expected on a chance basis alone. The results provided no evidence for a relationship between purported biorhythm cycles and accident likelihood. Possible reasons for belief in the biorhythm system may be that it is self-fulfilling coincidence, illusory correlation, or due to errors of logic and arithmetic in the biorhythm literature.

by John W. Shaffer; Chester W. Schmidt, Jr.; Howard I. Zlotowitz; Russell S. Fisher
 DOT-HS-198-3-770
 Publ: Archives of General Psychiatry v35 n1 p41-6 (Jan 1978)
 1978; 20refs
 Investigation administered by Maryland Medical-Legal Foundation, Inc., and by an institutional research grant from Baltimore City Hospitals.
 Availability: See publication

HS-024 221

RESPONSE OF HUMAN AND ANTHROPOMETRIC MODEL SKULLS TO IMPACT LOADING

An experimental study was undertaken in an effort to obtain data for evaluating and developing head protection, specifically that afforded by children's hockey helmets against skull fracture when struck by a hockey puck. Experimental strain/time results are presented for unprotected and protected human and anthropometric plastic model skulls under impact loading. Using a hockey puck as the projectile, the effectiveness of helmet suspensions and the likelihood of skull fractures with varying conditions of head protection were evaluated. Helmets had variable amounts of padding, and varied from loose-fitting to tight-fitting. An experimental arrangement is described; the strain-gauge technique demonstrated reliable, reproducible results. Peak stresses were found to occur above the orbit and in the temporal regions, results in agreement with

previous investigations. A massive, flexibly-suspended helmet was found to offer maximum protection from fracture-inducing blows, but is probably impracticable. A limited system analysis has corroborated the experimental results. Work is continuing to determine if the differences in stress orientation and magnitude between the more easily-used plastic skulls and fresh human skulls can be reconciled. One unexpected indication was that skull strains were lowest with a loose-fitting helmet and higher with a heavily padded or tight-fitting helmet.

by M. A. Townsend; D. McCammond; G. Lie
Publ: Medical and Biological Engineering v13 n3 p405-13 (May 1975)
1975; 20refs
Sponsored in part by National Res. Council of Canada.
Includes French and German summaries.
Availability: See publication

HS-024 222

FIXED ROADSIDE HAZARDS SYMPOSIUM. VERMONT SOUTH, VICTORIA, OCTOBER 1977

A compilation of papers on the subject of fixed roadside hazards, with particular reference to Australia, include an overview, current research in New South Wales, research into Victorian pole crashes, the institutional problem, legal implications, possible technical solutions, and cost benefits. Three workshops discuss utility poles, planted or naturally-occurring hazards, and highway and traffic authority associated structures.

Australian Road Res. Board, P.O. Box 156 (Bag 4),
Nunawading 3131, Vic., Australia
Rept. No. ARRMS-78/22; 1978; 177p refs
Includes HS-024 223--HS-024 229. Cover title: Joint
ARRB/DOT Fixed Roadside Hazards Symposium. Vermont
South, Victoria, October 1977.
Availability: Corporate author

HS-024 223

COLLISIONS WITH FIXED ROADSIDE HAZARDS-- AN OVERVIEW OF THE PROBLEM

Motor-vehicle collisions with fixed roadside hazards (FRH's) have received comparatively little research attention in Australia. A serious lack of relevant statistics complicates attempts to define the magnitude and nature of the problem. Based on the available information, it is clear that the frequency and severity of this type of traffic accident are high. Those accidents which are especially severe involve poles in urban areas and trees in rural areas. Little is known of the road-user, vehicle, and environmental factors involved. To develop a comprehensive program for remedial action it is necessary to adopt uniform definition of accidents involving FRH's in all states and territories, extend the National Fatal File to cover at least a 12-month period, collect selectively data on the frequency and characteristics of FHR's, and initiate studies of rural accidents involving FRH's. In the interim, immediate attention could be directed towards improving the safety of individual objects already identified as being hazardous, and rationalizing the number of FHR's, particularly through joint use of facilities by different organizations. The most common fatal accident involving FHR's has been tentatively identified as a

single-vehicle accident at night in which a male driver has been drinking; further research is required in this area.

by C. J. Boughton; P. W. Milne
Commonwealth Dept. of Transport, Australia
Publ: HS-024 222 (ARRMS-78/22), "Fixed Roadside Hazards Symposium," Vermont South, Vic., Australia, 1978
1978; 28p 21refs
Symposium held in Vermont South, Vic., Australia, 6 Oct 1977.
Availability: In HS-024 222

HS-024 224

CURRENT RESEARCH IN NEW SOUTH WALES [FIXED ROADSIDE HAZARDS]

The Traffic Accident Res. Unit (TARU) of the New South Wales (Australia) Dept. of Motor Transport has explored the crash involvement of various types of fixed roadside hazards. The types of hazard found cover a much wider range than is listed in statistical summaries of police reports, since these reports usually only mention roadside hazards when direct impact with specific objects is the chief cause of vehicle damage or occupant injury. Factors other than direct impact are discussed, and include the condition of delineation of pavement edges, obscuration by roadside objects, and the tripping of motor vehicles by minor roadside objects causing the impacting vehicle to roll. Results are reported on some of the current laboratory work being undertaken by TARU on vehicle occupant head movement during impacts and a program of vehicle side-impact tests. In this connection, it is concluded that Australian Design Rule 29 is not very effective in controlling pole intrusion (for which it was not in any case designed), but cushioning poles may be effective in situations where very bulky cushions are practicable. This leaves open the solution to the general problem of pole impacts.

by D. C. Herbert
New South Wales Dept. of Motor Transport, Australia
Publ: HS-024 222 (ARRMS-78/22), "Fixed Roadside Hazards Symposium," Vermont South, Vic., Australia, 1978
1978; 8p 9refs
Symposium held in Vermont South, Vic., Australia, 6 Oct 1977.
Availability: In HS-024 222

HS-024 225

THE UNIVERSITY OF MELBOURNE UTILITY POLE IMPACT STUDY: A PROJECT RESUME PRELIMINARY REPORT

A project is currently in progress to investigate the utility-pole traffic hazard problem in the Melbourne (Australia) metropolitan area, and includes a survey of vehicle crashes with utility poles, a random site survey to provide a control group, and analysis and report preparation. The accident survey has been completed. Between 8 Jul 1976 and 8 Mar 1977, an investigation was made of 879 vehicle crashes involving utility poles, both property-damage-only accidents, as well as casualty accidents. There were 31 fatalities and 374 injured persons as a result of these collisions. This preliminary report outlines the project objectives, the scope of the data collected, and the proposed project program. A breakdown of the accident sample by accident type (intersection, non-intersection; primary vs. secondary (based on whether or not the vehicle collided with another vehicle prior to impacting pole)), road

April 30, 1979

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class, curve involvement of non-intersection sites, accident severity, casualties according to primary or secondary type of accident, light conditions, road conditions, and time of week, is presented graphically. The survey of 800 randomly-selected sites is currently underway.

by J. C. Fox; M. C. Good; P. N. Joubert
University of Melbourne, Vic., Australia
Publ: HS-024 222 (ARRMS-78/22), "Fixed Roadside Hazards Symposium," Vermont South, Vic., Australia, 1978
1978; 13p 1ref
Symposium held in Vermont South, Vic., Australia, 6 Oct 1977. Sponsored by Commonwealth Dept. of Transport (Australia).
Availability: In HS-024 222

HS-024 226

ROADSIDE HAZARDS--THE INSTITUTIONAL PROBLEM

The frequency and severity of road accidents can be increased by the presence of roadside obstacles such as fences, utility poles, and trees. Historically and as a matter of convenience and economy, road rights of way have been selected for the location of most public utility services. The facilities that must be accommodated within the right of way, their interaction and influences on the location and type of surface structures are examined. Consideration is given to attempts to control the locations of these facilities and to the concept of responsibility for joint use. Underground facilities must also be considered since their location often affects the placement of above-ground facilities. Coordination of all public-utility programs must be achieved. The use of common trenching for such as sewer, water, and electricity, has been proposed for ease in access, economy, and reduction in the number of openings, and for aesthetic, environmental and traffic safety considerations. Problems of common trenching include maintenance, difficulty in predicting size for future expansion, and incompatible use (with possible danger to other services or workmen). Surface facilities include those associated with utilities, with road construction and traffic management, and those naturally occurring. The roadside safety problem could be solved by eliminating all obstacles, either by good design or technology, by removal or resiting; by identifying those objects most likely to be struck, and organizing selective removal, or by making harmless those obstacles which cannot be moved (e.g. frangible bases or impact attenuators); and by providing protection to and from those obstacles which cannot be removed or modified (e.g. guardrailings). There is much greater awareness of the problems than before, but the major costs for a safer roadside environment do not fall on those who ultimately benefit. There is little incentive for authorities to increase installation costs or remedy that which they do not regard as their responsibility. Coordination of expenditures between service authorities is difficult because of different revenue sources and budget years. Most cannot proceed with large costly work programs unless there is reasonable likelihood of satisfactory financial return. Voluntary coordination might work. An alternative is an overriding group concerned with overall roadway efficiency, backed by enabling legislation. Proponents of this course claim that the use of road rights of way has become so complex that the conflicting aims of the various authorities make it impossible for a voluntary balanced solution. However cooperation is arrived at, an effective financial structure is essential so that the service authorities can plan the physical coordination. A central fund might be used from which advances to authorities might

be made, thus ensuring that there is continuity of financing and that costs fall more directly on those benefitting.

by J. R. Jarvis; E. F. Mullin
Australian Road Res. Board, P.O. Box 156 (Bag 4),
Nunawading 3131, Vic., Australia
Publ: HS-024 222 (ARRMS-78/22), "Fixed Roadside Hazards Symposium," Vermont South, Vic., Australia, 1978
1978; 21p 20refs
Symposium held in Vermont South, Vic., Australia, 6 Oct 1977.
Availability: In HS-024 022

HS-024 227

ROADSIDE HAZARDS--THE LEGAL IMPLICATIONS

The various legal elements which must be proved by an injured party in a roadside-hazard case to satisfy the requirements of negligence and nuisance in Australian law are examined, and the limitations that have discouraged a more widespread use of the law in regulating the placement of fixed roadside hazards (FRH's) are discussed. To succeed in negligence actions, the plaintiff (usually an individual) must prove, on a balance of probabilities, that the defendant (usually public authorities or landowners) owed a duty of care, that the defendant's conduct fell short of the duty of care owed to the plaintiff, that the defendant's negligent act was the cause in fact of plaintiff's injuries, and that the plaintiff suffered legally-recognized damages. In public nuisance actions the plaintiff has to show an interference with any right common to the public. Unlike negligence, the essence of the claim is based upon the effect on the plaintiff, not on the cause. The plaintiff need only prove an injury for which the defendant is liable; it is no excuse that the defendant took reasonable care. The plaintiff also has to show that the invasion in question is a continuous condition which extends over a considerable period of time. In bringing suit for public nuisance, the plaintiff must also demonstrate that a loss or inconvenience was suffered which in some way differs from that which may be suffered by the general public. The related actions of negligence and nuisance continue to be the almost exclusive legal mechanisms available to the motoring public for the elimination or modification of the perils of FRH's. Public law developments in the U.S., such as analyzing the empowering statutes of highway authorities, safety organizations, and public utilities, and consequent suits for injunctive action against public bodies that fail to undertake action to remedy unsafe roads, have no parallel in Australia. More restrictive rules regarding locus standi in Australia and the traditional confines of injunctive relief make any such development highly unlikely in the near future. An Australian plan for a no-fault national compensation scheme for the injured was not implemented.

by Judd Epstein
Monash Univ., Australia
Publ: HS-024 222 (ARRMS-78/22), "Fixed Roadside Hazards Symposium," Vermont South, Vic., Australia, 1978
1978; 15p 10refs
Symposium held in Vermont South, Vic., Australia, 6 Oct 1977.
Availability: In HS-024 222

HS-024 228

HSL 79-04

HS-024 228

MOTOR VEHICLES VERSUS UTILITY POLES

For Victoria, Australia, various ways of maintaining separation between vehicles and utility poles are explored; some reasons behind the location of poles are examined and possible advantages and disadvantages of alternative courses of action are discussed. Because of the very large number of utility poles already in service (approximately 800,000) and the relatively small number being installed in vulnerable new locations, it is concluded that there is little more that the State Electricity Commission of Victoria can do to prevent them from being struck by out-of-control motor vehicles. In any case, removal of poles from urban areas would expose innocent parties to injury and/or damage from out-of-control vehicles and such action would not be in the best interests of road safety. The utility pole is a manifest symptom of a widespread problem, that of maintaining proper control of motor vehicles. To solve the real problem instead of treating the symptom, it is recommended that increased attention be devoted to the question of improving driver control, including vehicle condition, driver skill, consumption of alcohol, etc.; that motor vehicles be designed to make them more resistant to impact, particularly in a lateral direction; that the use of guard rails be increased at known problem locations to ensure containment of out-of-control vehicles; and that freeways and divided highways have central medians protected by guard rails or concrete separators, and that they be lit by high-output lamps mounted on tall poles within the median.

by Brian W. Casserly

State Electricity Commission of Victoria, Australia
Publ: HS-024 222 (AARMS-78/22), "Fixed Roadside Hazards Symposium," Vermont South, Vic., Australia, 1978
1978; 14p
Symposium held in Vermont South, Vic., Australia, 6 Oct 1977.

Availability: In HS-024 222

HS-024 229

ECONOMIC EVALUATION OF SAFETY IMPROVEMENTS TO FIXED ROADSIDE HAZARDS

The application of cost-benefit analysis to the evaluation of possible engineering solutions to fixed roadside hazards (FRH's) is studied. Most of these solutions entail construction and maintenance costs and result in benefits through a reduction in the number and severity of vehicle collisions with FRH's. The incidence of the types of costs and benefits which are likely to arise is discussed along with the way in which this and other considerations may be incorporated into the decision-making process. Some suggestions are made with regard to alternative approaches for collection and analysis of data. The means by which the organizations responsible for the construction of particular types of FRH's may be induced to implement economically-desirable engineering solutions are presented. The evaluation methodology outlined offers a theoretically acceptable approach to the economic evaluation of safety improvements to FRH's. Given sufficient effort, the tasks of preparing a hazard inventory, quickly costing a short list of appropriate engineering solutions, predicting the number and economic severity of collisions, and performing an economic evaluation, may be satisfactorily completed. These tasks necessitate that a model to predict the number and economic severity of collisions be formulated and calibrated.

research team. In addition, a certain level of engineering and economic expertise would be necessary to conduct the actual evaluation. The work involved would be considerably reduced if attention were initially focused on accident black spots or particular section of road and/or on a particular type of FRH such as utility poles.

by K. R. Mackay; A. J. Shaw

Commonwealth Dept. of Transport, Bureau of Transport Economics, Australia

Publ: HS-024 222 (AARMS-78/22), "Fixed Roadside Hazards Symposium," Vermont South, Vic., Australia, 1978
1978; 20p 22refs

Symposium held in Vermont South, Vic., Australia, 6 Oct 1977.

Availability: In HS-024 222

HS-803 218

AUTOMOBILE MARKETING STRATEGIES, PRICING, AND PRODUCT PLANNING. FINAL REPORT

The problems and practices of the U.S. automobile industry in product planning, pricing, and marketing are examined from the viewpoint of how current procedures inhibit or prevent the increased manufacture and sales of cars that are more fuel efficient and how these processes need to be understood and utilized by government regulatory agencies. By using a combination of direct work experience in three U.S. companies and a literature and field research effort, it is believed that the findings, conclusions, and recommendations presented are valid. A fuel-efficient vehicle mix meeting a reasonable timetable can be achieved by industry as long as interrelated requirements such as auto emissions and safety are clearly defined in time and are achievable within that time. The issue of what constitutes a reasonable timetable is addressed, recognizing the capacity limitations of industry and suppliers to accomplish a rapid change in product. With regulatory requirements placed upon the manufacturers, and the possibility of tax rebates or penalties placed upon the new-car buyer, there will be incentives to produce and buy a more fuel-efficient mix of vehicles. The missing link in promoting fuel-efficient vehicles is the independent-dealer organization and salespeople who carry out the key role of selling a car. Under current plans there is no incentive or penalty for the dealers and they continue to place emphasis on profitability, thus biasing their effort toward the traditionally larger, higher-priced, less fuel-efficient vehicles. The following recommendations concerning fuel-efficiency regulations are supported: recognition of reasonable new-model constraints, coordination of interrelated standards, e.g. fuel economy and emissions; widening of price and cost of ownership differential among models (rebates and annual tax on fuel-inefficient vehicles), public relations campaigns, and dealership-level incentives.

by H. M. Siegel; T. M. Burrows; C. J. LaCivita
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93017

DOT-TS-13632

Rept. No. DOT-TSC-NHTSA-77-7; 1978; 83p 93refs

Rept. for Mar 1977-Sep 1977.

Availability: NTIS

HS-803 341

THE POTENTIAL FOR AUTOMOBILE WEIGHT REDUCTION: OUTLOOK AS OF 1975-1976. FINAL REPORT

Automobiles of lighter weight than those current (1976 models) in the domestic market may be built in each of three size classes, 4-passenger, 5-passenger, 6-passenger, and this can be done within the limits of present designs and materials. Detailed weight breakdowns are presented for a 4-passenger vehicle of 1987 lb curb weight, for a 5-passenger vehicle having a curb weight of 2551 lb, and a 6-passenger vehicle of 3271 lb curb weight. Since weight reduction is without significance unless product characteristics are well defined, detailed package dimensions are presented for each of the three size classes, and an improved roominess factor is proposed. Other vehicle characteristics (e.g. fuel economy, durability, cost of maintenance, vision, steering, braking) are discussed in detail and defined. It is concluded that roominess, performance, active safety, luxury options, and other product qualities can be conserved in weight reduction, but super-power options and weight concessions to appearance factors are not included in weight estimates. Lightweight cars may be somewhat inferior to vehicles of heavier weight and equally advanced design with respect to impact with other vehicles and with certain kinds of fixed obstacles, aerodynamic stability, and smoothness and quietness of operation. Detailed weight comparisons are presented between present and past designs of vehicles in each of the three size classes. The weight history of three typical domestic vehicles (Ford Car, Maverick, and Pinto) is given in detail and analyzed for the period 1970-1974, during which time the weight consequences of industry response to government regulations occurred. The design process is outlined and illustrated by the making of design decisions for a new 5-passenger vehicle. Finally, the potential for weight reduction by material substitution is examined. Discussed in detail are aluminum, high strength low alloy steel, and plastics; a study is made of the weight decreases that could be achieved by use of those materials in automobile components where such use is technologically feasible.

by FREDERICK J. Hooven; Francis E. Kennedy, Jr.
Dartmouth Coll., Thayer School of Engineering, Hanover,
N.H. 03755
DOT-TSC-996
Rept. No. DOT-TSC-NHTSA-78-36; 1978; 216p 73refs
Rept. for Apr 1975-May 1976.
Availability: NTIS

HS-803 474

SEMINARS IN TRAFFIC CASE ADJUDICATION. FINAL REPORT

Findings, conclusions, and recommendations are presented from two-day, small-group seminars for identifying and analyzing problems in a state's traffic case adjudication system and for developing action plans for solving those problems. The objectives of the seminars, held in Arizona (1978), Alabama, Arkansas, and Maryland (1977), were to develop relationships between National Hwy. Traffic Safety Administration (NHTSA) policies and standards and traffic safety; to provide information about modern management techniques for improving internal operations of traffic courts; to help increase information exchange and cooperative planning for improving external administration of traffic courts and the traffic safety system as a whole; and to help adminis-

trators from traffic court systems and individual traffic courts in understanding mutual problems and in developing methods for better interaction. It is concluded that the seminars provided an effective mechanism for top-level traffic law system (TLS) managers to analyze the operation of that system. The following recommendations are made: conduct additional seminars in other states, make NHTSA regional offices and Governors' Representatives for Hwy. Safety aware of the existence and value of the seminars, use the seminar manual as a basis for a series of seminars addressing a wide range of topics, and revise the seminar manual to eliminate any explicit or implicit emphasis on Proposed Standard N-7.

by Ralph K. Jones
Mid-America Res. Inst., Inc., 3720 Lamplighter Drive, Ann Arbor, Mich. 48103
DOT-HS-6-01371
Rept. No. MARI-78-1; 1978; 27p 4refs
Rept. for 9 Jun 1976-9 Apr 1978.
Availability: NTIS

HS-803 527

WORKSHOP ON UNREGULATED DIESEL EMISSIONS AND THEIR POTENTIAL HEALTH EFFECTS--EDITED TRANSCRIPT OF PROCEEDINGS. APRIL 27-28, 1978

With the advent of the fleet average fuel economy standards for passenger cars and light trucks, the international passenger car and truck manufacturers have sought cost-effective means of improving fuel economy, one singularly important way being the dieselization of fleets. With the many unknowns concerning unregulated diesel emissions and their potential impact on human health, the responsible government agencies, the National Hwy. Traffic Safety Administration, the Dept. of Energy, and the Environmental Protection Agency, have taken a cautious attitude regarding a major shift into diesel engines until more is learned. All three agencies have been actively studying the problems of diesel emission measurement, control, dispersion, and chemical transformation and medical effects. This workshop, which had extensive participation from industry, universities, government agencies, and concerned citizens, provided an opportunity to exchange information among experts, policymakers, and interested parties in the following areas: emissions characterization and measurement, control technology, factors affecting human exposure, and health effects.

National Hwy. Traffic Safety Administration
1978; 684p refs
Cosponsored by the Department of Energy and the Environmental Protection Agency.
Availability: NTIS

HS-803 535

THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION TRIAL SUBSTITUTE MOTOR VEHICLE INSPECTION PROGRAM

A compendium is presented of the National Hwy. Traffic Safety Administration's Trial Substitute Motor Vehicle Inspection Prog. conducted in cooperation with 12 states (California, Connecticut, Iowa, Kansas, Maryland, Michigan, Nevada, North Dakota, Ohio, Tennessee, Washington, and Wisconsin). Each state had the opportunity to determine the effectiveness

of alternative inspection programs compared to periodic motor vehicle inspection (PMVI). While each state drew somewhat different conclusions from its study, a common theme was apparent throughout all the studies: an appallingly high number of vehicles operating on the roads had mechanical defects and these defects were detected through the inspection process. In general, the states found that the majority of vehicles-in-use (VIU) would not pass an inspection at any given time. Those states that addressed the problem found that critical safety outage rates rapidly increased with age. All states agreed that some form of vehicle inspection is beneficial, particularly if it is concentrated upon older vehicles. The average age of passenger cars in use in the U.S. was 6.16 years in 1976, and is increasing. Forty-six percent of the cars were six or more years old. While a few alternative programs to PMVI showed promise, none conclusively demonstrated improvements in vehicle safety condition which would affect all vehicles, and, because of this, there is no justification to amend the PMVI standard. Descriptive summaries are provided of the trial substitute motor vehicle inspection programs conducted between 1972 and 1977 in 11 states; Kansas has not completed its program and is not included.

by Leslie E. Eder; Noel Bleich; Mario Damiata
National Hwy. Traffic Safety Administration, Office of State Vehicle Programs, Washington, D.C. 20590
1978; 66p 12refs
NHTSA Technical Rept.
Availability: NTIS

HS-803 547

STUDY OF CONSUMER AUTOMOTIVE PREFERENCE WITH REGARD TO FUEL ECONOMY MEASURES. FINAL REPORT

An analysis is made of the effects of size and weight reductions of 1977 General Motors (GM) standard-size cars. A buyer profile describing demographic characteristics, age, sex, education, marital status, size of family, and income by make is prepared for 1976 and 1977 GM standard-size cars, and 1977 Ford Motor Co. and Chrysler Corp. cars. The analysis focuses on testing whether significant differences exist between the average attitudinal, behavioral, and demographic profiles of two a priori defined groups, buyers of downsized and buyers of non-downsized cars. Multivariate analysis determined the variables that were the major discriminants. It is shown that attributes related to fuel economy are important discriminants distinguishing buyers of downsized from non-downsized standard-size cars. Those who purchased the downsized cars did so with the expectations (that were fulfilled) of better fuel economy, as well as of increased maneuverability and ease of parking. They reinforced the pursuit of fuel economy by also choosing 6-cylinder engines and manual transmissions to a greater extent. Share of market, market composition, source of sales, and owner loyalty are discussed. It is concluded that the GM downsizing of its standard-size cars was a significant fuel-economy measure and a success in the marketplace as well.

by Paul E. Green; Peter W. Rogers
Rogers National Res., Inc., 5800 Monroe St., Sylvania, Ohio 43560
DOT-TSC-1391
Rept. No. DOT-TSC-NHTSA-78-38; 1978; 50p
Rept. for Jul 1977-May 1978.
Availability: NTIS

HS-803 553

PENALTIES FOR TRAFFIC OFFENSES

The various penalties which may be assessed for violating traffic laws comparable to the provisions of Chapter 11 of the Uniform Vehicle Code (UVC), are reviewed for the 50 states and the District of Columbia. The penalties are compared from one state to another and from one offense to another. The basic approaches to penalization, and the specific penalty options such as fine, imprisonment, and some of the more novel post-conviction remedies are examined. Provisions of the UVC as last amended in 1975 with the relevant state law provisions in effect as of 1 Jan 1977 are compared. The analysis focuses on the penalties for reckless driving, driving while under the influence (DUI), homicide by vehicle, and seven other somewhat less serious traffic offenses (failure to obey an officer directing traffic, following too closely, stop sign violation, failure of pedestrian outside crosswalk to yield, failure to stop for a school bus, violation of the basic speed rule, and stopping, standing, or parking where prohibited). Apart from the fact that the fine is a universal penalty option, there is little uniformity in statutory traffic penalties. Most traffic offenses are considered misdemeanors. In about half of the states, however, one or more of the serious offenses is classified as a felony, or has a felony-type penalty. In 17 states, some traffic offenses have been given less than misdemeanor status, and are called infractions. The typical statute specifies a penalty range within which the court may assess the penalty. Repeat offender penalty increments are quite common. Most states have retained imprisonment as a penalty option, especially for the serious offenses. The fine is the most prevalent penalty option. Only six states have vehicle code sections which specifically authorize installment imprisonment, i.e. allowing the person to serve jail time on weekends or at other times when not working. About half the states now have programs for alcohol/drug abusers which may be imposed in addition to or in lieu of other penalties. Fifteen states have laws which authorize other driver improvement remedies (e.g. driver improvement courses).

by John W. English; Robert S. Want
National Com. on Uniform Traffic Laws and Ordinances
DOT-HS-5-01121
Publ: Traffic Laws Commentary v7 n4 (Sep 1978)
1978; 88p refs
Availability: GPO, stock no. 050-003-00325-5

HS-803 565

HIGHWAY SAFETY MANAGEMENT PROCESS GUIDELINES

Recognizing that the State Hwy. Safety Agencies (SHSA's) are in various stages of transition from a Standard's implementation approach to a total management process, these guidelines are intended to assist in improving present procedures, establishing a systematic way to manage the highway safety program. The guidelines provide criteria to institutionalize the SHSA management functions and related organizational structures, and to identify the roles and inputs of National Hwy. Traffic Safety Administration headquarters, regions, and state and local operating agencies relative to these functions. Replacing the sanction-related, authoritarian approach of the past, the management process should result in an improved participative framework, one of cooperation between Federal, state and local authorities. The classical management definitions are converted to commonly used

highway safety terms. For each of the five phases of the management process (planning, programming, implementation, monitoring and review, and evaluation) the component parts are addressed, including the key steps for each part. The process is described from the SHSA perspective.

National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
1978; 49p
Availability: NHTSA

HS-803 591

ACCIDENT INFORMATION RELATED TO DRIVER VISIBILITY AND MIRRORS. PT. 1, FINAL REPORT, AND PT. 2, DRIVER VISIBILITY SURVEY FORMS, CATEGORY NUMBERS 1, 2 AND 3

A survey was conducted of employees of a traffic accident investigation firm (GAB Business Services, Inc.) located throughout the 50 states, Puerto Rico, and the District of Columbia, in order to collect basic data on vehicular accidents that relate to a driver's visibility. Separate data (on forms filled out by the survey participants) are furnished for individual accidents in each of three categories (a fourth category, and a miscellaneous group of accidents were included in the survey but not reported herein). The first category of accidents involves those where an obstruction in the driver's line of sight by something on the vehicle was apparently a contributing factor. Examples include obstruction of the driver's field of view by outside or inside mirrors or large "A" pillars, blockage of view when lane changing because of louvers or large "C" pillars, obscuration of the roadway system by special equipment or recreational vehicles or trucks, and blockage of a bus driver's view of pedestrians at intersections or when loading or unloading passengers. The second category of accidents involves those where the mirror system apparently did not provide the driver with an adequate view. Examples include no mirror on the right side to provide a view when lane changing, inadequate mirror view when merging into faster traffic, lack of a cross-view or an adequate right side mirror on school buses to monitor children when loading and unloading, and blind spots directly behind commercial vehicles. The third category of accidents involves those where the outside mirror and/or mirror mounting struck a pedestrian, bicyclist, or motorcyclist. Examples include both initial striking of a victim and secondary impact where the victim was hit by the vehicle and then struck by the mirror. Percentage representation of various factors (under the headings of time of day, location, weather conditions, road conditions, road surface, property damage, point of impact, injuries (not serious, serious, fatal), accident description, and type of vehicle) for each of the three accident categories is tabulated.

by John H. Allred
GAB Business Services, Inc., 4201 Connecticut Ave., N.W.,
Washington, D.C. 20008
DOT-HS-8-01946
1978; 251p
Availability: Reference copy only

HS-803 596

RESEARCH SAFETY VEHICLE PHASE 3. STATUS REPORT NO. 10, 1 JULY TO 31 AUGUST 1978

In this reporting period, considerable effort was devoted to the resolution of the problems posed by the failure of the occupants of Car No. 5 to demonstrate survival in Test No. 10, the last of the planned Phase III car crash test; and to the fabrication of the Phase IV vehicles. Test No. 10, the barrier test of the Phase IV RSV (research safety vehicle) prototype, was run with a driver air bag and a passenger air belt for the front-seat restraint systems. Although the front structural performance seemed excellent and intrusion and pitch were minimal, the accelerations in the occupant compartment measured near 70 G's and neither front-seat occupant demonstrated survival. The driver's air bag allowed chest acceleration and one femur load to exceed allowable limits. A seam failure occurred in the passenger's air belt restraint system which allowed the passenger's head to hit the instrument panel resulting in an unsatisfactory head response. Both driver and passenger registered HIC (Head Injury Criterion) numbers higher than the permissible value of 1000. Both the Chrysler and Calspan RSV groups are involved in efforts to resolve the problem. Calspan is reviewing the restraint system and attempting to simulate the occupant's kinematics in order to evaluate the restraint system's ability to provide satisfactory results in such a barrier crash. The Chrysler group is approaching the problem from the standpoint of the structure, using the simulation route, to explore possible ways and means of reducing the severity of the crash pulse to which the occupants are exposed. Significant progress was made in both simulation efforts, and a better understanding of the phenomena involved was gained. With respect to the build program, two pedestrian crash bucks that constitute two of the ten vehicles in the program were accepted on the basis that the missing items (i.e. the bumper, windshield, and rear-view mirrors) would be retrofitted. Dates for the delivery of the various items required for the completion of the first complete car, Vehicle No. 3, were received. These are consistent with the vehicle's delivery in the first week of Oct.

Calspan Corp., Calspan Advanced Technology Center, P.O.
Box 400, Buffalo, N.Y. 14225
DOT-HS-7-01551
Rept. No. PR-10; 1978; 86p
Availability: Reference copy only

HS-810 330

STATEMENT BEFORE THE SENATE COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION, SEPTEMBER 7, 1978

Senate bill 3431, to govern the application of state limits on the length of tractor-trailer combinations used on the Interstate system reflects increased Federal concern about present state truck length laws which have resulted in the design of truck cabs that do not adequately provide for the safety and comfort of commercial truck drivers. It is based on two presumptions: that the states should continue to set truck length limits, and that the fairest and most expeditious way of assuring the proper protection of truck drivers is to remove, by legislation, the economic incentive for using truck cab space for carrying cargo. Specifically, the bill would require that if a state sets limits on truck lengths used on the Interstate system after 1 Jun 1980, it must set them on the trailer alone, or, if a state desires to set overall tractor-trailer length limits as well, the

overall limit would have to exceed the trailer length by at least 15 ft. The sanction provided is loss of a state's Federal funds for Interstate highway construction. The states would also be prohibited from setting any new trailer limits that would make unlawful any trailer lawfully in use in the state before the date of the bill's enactment. The welfare of the drivers of commercial vehicles has often been ignored in some of the occupant compartment designs (e.g. limited space between driver and dashboard, inadequate and ill-fitting fiberglass cover on the part of the engine that protrudes into cab). The Dept. of Transportation (DOT) has conducted some research into the safety implications of a reduction in size of truck cabs and occupant compartments and is considering safety regulations to specify minimum size and performance requirements for the cab portion of regulated commercial vehicles. DOT views S. 3431 and its own rulemaking activity as complementary, and supports the bill. DOT does not have the authority to amend existing state requirements to lessen the economic impact of taking away cargo-carrying space. The Senate bill is designed to protect the interests of the trucking industry as well as those of the drivers, in allowing the states to accommodate any economic impacts. Tractor length increases could improve braking, handling and stability, driver comfort and safety, ride quality, cab ingress and egress, aerodynamics and fuel tank location. Safety problems might occur from requiring states to set length limits specifically for the cargo-carrying units of trucks. Any increase in length would increase overtaking time. On Interstate highways the effect on safety of passing longer vehicles will only be slight; on two-lane roads longer vehicles pose a problem. Present accident data show that the safety records of the longer combinations operating west of the Mississippi are comparable to the 55-ft vehicles operating in the East.

by Joan B. Claybrook
National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
1978; 11p 1ref
Availability: Corporate author

HS-810 331

**STATEMENT BEFORE THE SUBCOMMITTEE ON
CONSUMER PROTECTION AND FINANCE, HOUSE
COMMITTEE ON INTERSTATE AND FOREIGN
COMMERCE, CONCERNING AUTO REPAIR
PROBLEMS AND TITLES II AND III OF THE
MOTOR VEHICLE INFORMATION AND COST
SAVINGS ACT, SEPTEMBER 14, 1978**

The National Hwy. Traffic Safety Administration's (NHTSA) evaluation of the auto repair and maintenance problem is presented and the most effective means of addressing the problem, including the role of diagnostic inspections and further implementation of Titles II and III of the Motor Vehicle Information and Cost Savings Act is outlined. There are many causes for the large consumer losses that result from automobile maintenance and repair practices (losses averaging about \$150/vehicle/year). The automobile manufacturing industry, the service and repair industry, and consumers themselves all bear some responsibility for the present situation, and for improving it. An effective solution requires a multi-faceted approach that fundamentally improves vehicles, the process of keeping them in good repair, and the capability of the consumer to ensure that the vehicle is kept in good running order with a minimum of cost and inconvenience. The automobile owner particularly needs information to allow for informed

choices of vehicles and their upkeep, and to protect against improper or even corrupt practices in the maintenance/repair industry. The service/repair industry needs to have the personnel and equipment to correctly diagnose and repair vehicle problems. The automobile manufacturers must design and construct cars which are easier to diagnose and service; this is within the state-of-the-art but it has not been given high priority by vehicle manufacturers. The Federal government can play a key role in the auto repair field as a catalyst for state, local, and consumer actions. Six specific ways that the Federal government might help consumers and the auto repair industry are to continue support to state and local governments in developing diagnostic motor vehicle inspection programs, provide legal remedies for consumers including rights of action for cases of fraud or other illegal activity in auto repair, promulgate vehicle standards that can reduce maintenance requirements and warn owners of the need to repair or maintain their vehicles, develop consumer information to aid people in their selection of motor vehicles and to help them understand their vehicle's maintenance requirements, investigate and regulate unfair trade practices under the authority of the Federal Trade Commission, and provide governmental assistance to foster the establishment and operation of consumer cooperatives.

by Joan B. Claybrook
National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
1978; 24p refs
Availability: Corporate author

HS-810 332

**REMARKS BEFORE THE NATIONAL AUTOMOBILE
DEALERS ASSOCIATION, MCLEAN, VIRGINIA,
SEPTEMBER 13, 1978**

The American public is interested in improving safety in motor vehicles, in maximum feasible fuel economy, and in efficient automobile repair. In a recent survey carried out for the National Hwy. Traffic Safety Administration (NHTSA), nearly three out of four people rated "safety and safety features" as being of major importance in deciding what kind of car to buy. Interest in safety (72%) was topped only by cost (85%), gas mileage (another area of Federal regulation, 77%), and repair record (75%). Safety was rated as being of major importance more often than traditional characteristics such as interior comfort and style (50%), preference for a particular make (47%), and resale value (45%). Many of those latter items are the ones dealers often rate most important to their customers. Consumers also demonstrated a decided taste in the safety systems wanted; e.g. by a two to one margin, the people surveyed thought that the government should require automakers to develop automatic passenger crash safety equipment rather than encourage greater seatbelt use; and two out of three people thought cars should be built with as many safety features as possible. About 1/3 of the respondents would choose an air bag regardless of cost differences within reason; 1/3 preferred automatic belts regardless of the price differential; and of the remainder, about 1/2 based their decision on the relative price of the two systems, the rest not expressing an opinion. The public wants safe cars, but it wants the safety built in, not buckled in. Eighty-six percent of the people think that brakes designed to reduce skidding would be a good idea, and 71% rate the five-mile-an-hour bumper a good thing. NHTSA believes that automotive dealers, as the link between the public and the auto manufacturers, could serve as the public's ad-

April 30, 1979

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vocate to seek basic improvements in the industry, and that they should increase their efforts to inform consumers about safety, rights under the law, and technical aspects of cars (to aid in consumer decisionmaking about repairs, parts replacement, and prices). The automotive industry's sales and service representatives could benefit their industry and their customers if they would look at their industry from the perspective of the consumer.

by Joan Claybrook
National Hwy. Traffic Safety Administration, Washington,
D.C. 20590
1978; 9p
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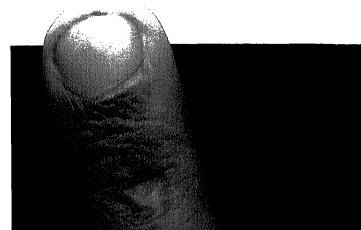
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BEGINNING DRIVERS

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[METHYLCYCLOPENTADIENYL MANGANESE
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